



Risk and protective factors related to children's symptoms of emotional difficulties and hyperactivity/inattention during the COVID-19-related lockdown in France: results from a community sample

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Title page

Title: Risk and protective factors related to children's symptoms of emotional difficulties and hyperactivity/inattention during the COVID-19 related lockdown in France: results from a community sample

Running head: Mental health in children during COVID-19

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45 **ABSTRACT**

46 **Objective:** The COVID-19 epidemic has spread worldwide since December 2019.
47 To contain it, preventive measures including social distancing, economic shutdown, and
48 school closures were introduced, carrying the risk of mental health burden in adults and
49 children. Although the knowledge base regarding children's response to trauma and
50 adverse events in general has broadened, descriptions of their mental health during
51 epidemics remain scarce. In particular, the role of family socioeconomic characteristics
52 and parental mental health are poorly understood. **Methods:** We assessed the correlates
53 of children's emotional difficulties and symptoms of hyperactivity/inattention during the
54 COVID-19 lockdown in a French community-based sample. Data came from 432
55 community-based parents (27-46 years, TEMPO cohort) and their children (mean age 6.8
56 +/- 4.1) interviewed online. Children's symptoms of emotional difficulties and
57 hyperactivity/inattention were assessed using the parent reported Strengths and
58 Difficulties Questionnaire during the 5th week of home confinement. Family socioeconomic
59 characteristics and parental mental health and substance use were assessed weekly
60 during the first 5 weeks of home confinement. Data were analyzed using logistic
61 regression models. **Results:** 7.1% of children presented symptoms of emotional difficulties
62 and 24.7% symptoms of hyperactivity/inattention. Family financial difficulties and parental
63 symptoms of anxiety and depression, as well as children's sleeping difficulties and screen
64 time, were associated with the presence of psychological difficulties. **Conclusion:**
65 Children's emotional and behavioural difficulties are associated with parental mental health
66 and socioeconomic difficulties. In the unprecedented situation of the COVID-19 epidemic,
67 parents and professionals involved in caring for children should pay special attention to

68 their mental health needs.

69 **Keywords:** Children's mental health; self-report; epidemiology; community survey:

70 COVID-19

72 1. Introduction

73 As the coronavirus (COVID-19) epidemic progresses worldwide, on March 17th 2020 the
74 French Government ordered a nationwide lockdown, with strict social restrictions and
75 limitations of individuals' movements. Families were confined to their homes, with the risk
76 of job loss, salary reduction or closure of regular activities such as schools. According to
77 UNESCO, as of April 1st 2020, the infection has caused 194 countrywide closures around
78 the world, thus affecting 1 598 099 000 students, knowing that school closures have been
79 shown to have an impact on children psychological difficulties [1-3], school closure may
80 also cause disruptions in physical activity, social interactions, and mental health of children
81 and adolescents.

82 Prior studies on the health impact of a quarantine [1, 4, 5] have shown that when children
83 are out of school, they are physically less active, have longer screen time and irregular
84 sleep patterns, resulting in weight gain and loss of cardiorespiratory fitness, which can all
85 subsequently impact their psychological well-being.

86 There is evidence that in some special populations, such as children of health workers [6],
87 children with a chronic disease [7] as well as those suffering from ADHD before the
88 epidemic [8, 9], the COVID-19 outbreak and the accompanying disease containment
89 measures introduced had an impact on psychological well-being. However, though
90 research highlights children's mental health risks associated with anxiety, lack of peer
91 contacts, reduced opportunities for stress regulation or parental mental illness [10-12], and
92 several reports [1, 13, 14] call for further research, to date there is little epidemiological

93 data on the mental health of children drawn from the community in face of the COVID 19
94 epidemic.

95 Given the well-known associations between family characteristics such as parental mental
96 health [15-17], low socioeconomic position [17] [18] and offspring high risk of poor mental
97 health[15, 16], we chose to specifically examine the role of these factors.

98 The current study

99 The aim of our study was to assess family and individual correlates of children's symptoms
100 of emotional difficulties and hyperactivity/inattention in a community-based sample in
101 France.

102 We assumed that children's characteristics such as sleeping difficulties, elevated screen
103 time use, as well as the family's circumstances including parents' marital situation (single
104 vs. living together), financial difficulties, low income and unstable work situation during
105 lockdown, parents' symptoms of anxiety and depression or substance use, and parents'
106 experience of COVID-19 symptoms were correlated to children's psychological difficulties
107 and studied these characteristics.

108

109

110 **2. Methods**

111 *2.1 Setting and study design*

112 Data for this study come from a longitudinal survey of a cohort of parents who took part in
113 the 2020 online assessment of the TEMPO (Trajectoires EpidéMiologiques en Population)

114 COVID 19 study (www.tempo.inserm.fr).

115 *2.1.1 Sample characteristics*

116 The TEMPO study was set up in 2009 to examine associations between life circumstances
117 and substance use and mental health in young adults. All TEMPO participants have a
118 parent who took part in the GAZEL cohort study [19, 20]. TEMPO study participants were
119 recruited in 1991 when 2,585 children aged 4-16 were selected to take part in a survey of
120 their mental health. In 2009, all 1991 study participants (aged 22-35 at the time) were
121 invited to participate again: 1103 agreed, of whom 752 agreed to a longitudinal follow-up
122 [21]. In 2011, we conducted a new wave of data collection and the study sample was
123 expanded to all GAZEL participants' offspring aged 18 to 37 years [22]. (Figure 1). The
124 TEMPO study received approval from France's national committees for data protection
125 (CCTIRS: Comité Consultatif sur le Traitement des Informations pour la Recherche en
126 Santé; CNIL: Commission Nationale Informatique et Liberté).

127 *2.2 Sample*

128 On March 17th 2020, 7,730 cases of COVID-19 were reported by France's public health
129 authorities, among them 2759 were hospitalized and 700 were in intensive care [63],
130 pushing the French government to order a nationwide lockdown. From March 24th to April
131 28th 2020, TEMPO participants were invited by email to complete a weekly online
132 questionnaire. The 4 initial questionnaires focused on socio-demographics, work
133 characteristics, COVID-19 infection, general and mental health, as well as substance use.
134 During the 5th week of lockdown, the questionnaire assessed participants' children's
135 mental health and was completed by 432 participants. Participants who had more than one
136 child were asked to complete the questionnaire in reference to their youngest child.

137 Sample characteristics are described in **Table 1**. In total, 432 participants, including 276
138 women (65%) and 148 men (34.9%), completed the study questionnaire about their
139 children: 31 (7.2%) children had signs of emotional difficulties and 107 (24.8%) of
140 symptoms of hyperactivity/inattention.

141 **2.3 Ethical section**

142 The TEMPO study received approval from France's national committees for data
143 protection (CCTIRS: Comité Consultatif sur le Traitement des Informations pour la
144 Recherche en Santé; CNIL: Commission Nationale Informatique et Liberté).

145 **2.4 Measures**

146 **2.4.1 Children**

147 We used the SDQ to ascertain symptoms of emotional difficulties and
148 hyperactivity/inattention.

149 **2.4.1.1 Emotional and hyperactivity/inattention symptoms**

150 Children's symptoms of emotional difficulties as well as hyperactivity/inattention were
151 reported by parents using the Strengths and Difficulties Questionnaire (SDQ) during the 5th
152 week (from 20th to 26th of April 2020) of home confinement. The SDQ is a brief, 25-item,
153 measure of behavioral and emotional difficulties that can be used in children and young
154 people aged 4–17 years [23-25]. In this study, we used 2 subscales: "emotional difficulties"
155 and symptoms of "hyperactivity/inattention", with 5 items each. Each item was scored on a
156 3 points ordinal Likert scale (0 "not true"; 1 "somewhat true"; 2 "certainly true"). A cut-off of
157 >3 out of 10 was used to detect high symptom levels on emotional difficulties scale and of
158 >5 out of 10 to detect high symptoms levels on hyperactivity/inattention scale. The internal

159 consistency of the subscales was acceptable (Cronbach's α of 0.62 for emotional
160 difficulties and 0.74 for symptoms of hyperactivity/inattention).

161 *2.4.1.2 Risk factors of children's psychological difficulties*

162 Risk factors studied in this investigation included children's age, sleep and screen time
163 use, family socio-demographic characteristics, parents' mental health and substance use,
164 and parents' experience of COVID-19 symptoms.

165 *2.4.1.3 Children's characteristics (sociodemographics, sleeping difficulties, screen time)*

166 The child's sociodemographic characteristics included sex (female vs. male), age (> or =<
167 6 years old).

168 *Sleeping difficulties* were assessed by the following questions: "During the preceding 7
169 days, did your child have difficulties sleeping that: appeared or increased or decreased or
170 disappeared or stayed stable or no difficulties." We created the following categories
171 "Sleeping difficulties (including "sleeping difficulties that "appeared" or "increased" or
172 "stayed stable") vs. "No sleeping difficulties" (including "no difficulties", or "difficulties
173 disappeared" or "difficulties decreased").

174 *Screen time* was assessed by the following questions: "During the preceding 7 days, how
175 much time has your child spent in front of a screen (TV, tablet, computer, smartphone..)
176 per day. We created the 2 following categories: "Less than 1 hour", vs. "More than 1 hour",
177 based on the American Academy of Pediatrics new Recommendations for Children's
178 Media Use [61]

179 *2.4.2 Parents*

180 2.4.2.1 *Family socio-demographic characteristics*

181 Socio-demographic characteristics studied include: family situation (single vs. couple),
182 financial difficulties in the preceding 5 weeks (yes vs. no), household monthly income
183 (2500 euro or less vs. > 2500 euro)(in reference to the average income in France) [62] and
184 work situation during lockdown (normal /distance working vs. job loss/ unemployment vs.
185 sick leave).

186 2.4.2.2 *Parents' mental health*

187 To assess *parents' symptoms of anxiety and depression* during the first 5 weeks of
188 lockdown, we used weekly repeated measures of the subscale assessing anxious-
189 depressed symptoms in the Adult Self Report Scale (ASR) [26], creating a dichotomized T-
190 score with a cut-off based on +1 standard deviation from the mean. Additionally, using an
191 assessment of ASR-based anxious-depressed symptoms obtained in the TEMPO study in
192 2018, we also identified parents' symptoms of anxiety and depression before lockdown,
193 which were studied in additional analyses.

194 2.4.2.3 *Parents' substance use*

195 Participants reported levels of substance use and abuse during the first 5 weeks of
196 lockdown in weekly questionnaires.

197 *Tobacco smoking status* was assessed using the following question in week 1: "Are you a
198 regular or occasional smoker?" coded yes vs. no.

199 *Alcohol use* was assessed using the French version of the Alcohol Use Disorders
200 Identification Test (AUDIT-C) [27, 28]. This brief three-item alcohol screening tool
201 developed by the WHO focuses on the frequency and quantity of alcohol consumption

202 [29], matches DSM IV criteria for alcohol abuse and dependence and is validated against
203 clinical diagnosis. Audit-C test scores of 3 or more for women and 4 or more for men were
204 considered to indicate a heightened risk for hazardous drinking/alcohol use disorder [29,
205 30].

206 *2.4.2.4 COVID-19 symptoms of the parents*

207 Parents' COVID-19 symptoms during the first 5 weeks were ascertained weekly by the
208 following question: "Did you present symptoms of COVID-19 infection (fever, cough, loss
209 of taste or smell)"? Based on participants' weekly repeated responses ("yes" vs. "no") we
210 created a variable indicating the presence of symptoms prior to the measure of children's
211 psychological difficulties.

212 *2.5 Statistical analyses*

213 First, descriptive statistics including frequencies and percentages were used to
214 characterize the study population (Table 1). We tested bivariate associations between
215 potential individuals and family risk factors, and children's symptoms of emotional
216 difficulties or hyperactivity/inattention using the Chi square test (**Table 2** and **Table 3**).

217 Second, to identify factors associated with children's emotional difficulties and symptoms
218 of hyperactivity/inattention, we used logistic regression with the alpha value set at $P < 0.05$.
219 We built one model, adjusting for the child's age and sex, and an additional multivariate
220 model adjusting for all variables that were significantly associated with the study outcomes
221 in bivariate analyses.

222 *Additional analyses*

223 We tested for statistical interactions between children's age and sex on the one hand and
224 parents' mental health and financial difficulties on the other. None of these statistical
225 interactions were statistically significant.

226 All statistical analyses were conducted using STATA 16.1 (StataCorp, College Station,
227 Texas, USA).

228 **3. Results**

229 *3.1 Sample characteristics (Table 1)*

230 Sample characteristics are described in **Table 1**. In total, 432 participants, including 276
231 women (65%) and 148 men (34.9%), completed the study questionnaire about their
232 children: 31 (7.2%) children had signs of emotional difficulties and 107 (24.8%) of
233 symptoms of hyperactivity/inattention.

234 **Table 2** and **Table 3** show factors associated with children's emotional difficulties and
235 symptoms of hyperactivity/inattention.

236 *3.2 Risk factors of children's emotional difficulties and symptoms of* 237 *hyperactivity/inattention (Tables 2 & 3)*

238 *Emotional symptoms*

239 Age- and sex-adjusted logistic regression analyses (**Table 2**) showed that the odds of
240 children's high levels of emotional difficulties were elevated among those who had
241 sleeping difficulties (OR 2.6, 95% CI 1.2– 5.7), whose screen time was more than 1 hour
242 per day (OR 6.8, 95% CI 1.5 – 30.9), whose parents had symptoms of anxiety-depression

243 during lockdown (OR 8.1, 95% CI 2.4– 26.8), or who had financial difficulties (OR 4.2, 95%
244 CI 1.6– 11.0).

245 Family situation (OR 1.2, 95% 0.6-2.7), the number of children in the family (OR 1.0, 95%
246 0.3-3.2), income (OR 1.1, 95% 0.5-2.4), job situation (OR 1.6 95% 0.7-3.5), COVID-19
247 symptoms (OR 1.7, 95% 0.5-5.3), and parents' substance use, such as tobacco
248 consumption (OR 2.3, 95% 0.8-6.6) and problematic alcohol consumption (OR 0.7, 95%
249 0.1-3.8) were not associated with children's high levels of emotional difficulties.

250 These associations did not change in a multivariate regression models, except for sleep
251 difficulties and financial difficulties, which were no longer associated with children's
252 emotional symptoms.

253 *Symptoms of hyperactivity/inattention*

254 Age- and sex-adjusted logistic regression analyses (**Table 3**) showed that the odds of
255 children's symptoms of hyperactivity/inattention were elevated among children who had
256 sleeping difficulties (OR 2.0, 95% CI 1.1-3.3), had parents with symptoms of anxiety or
257 depression (OR 2.6, 95% CI 1.1-1.2), financial difficulties (OR 2.3, 95% CI 1.1-4.6), or who
258 were unemployed (OR 1.8, 95% CI 1.1-3.3).

259 The child's screen time (OR 1.3, 95% CI 0.9-1.9), the responding parent's sex (OR 0.7,
260 95% CI 0.4-1.2), the family situation (OR 1.4, 95% CI 0.9-2.3), the number of children in
261 the family (OR 0.6, 95% CI 0.3-1.5), parents' substance use such as tobacco consumption
262 (OR 0.8, 95% 0.4-1.6) and problematic alcohol consumption (OR 1.2, 95% 0.7-1.9),
263 COVID symptoms (OR 0.9, 95% CI 0.4-2.1), or income (OR 1.0, 95% CI 0.6-1.7) were not
264 associated with children's elevated levels of symptoms of hyperactivity/inattention.

265 These associations did not change in a multivariate regression model, except for sleeping
266 difficulties and parental work situation, which were no longer associated with children's
267 symptoms of hyperactivity/inattention.

268 **4. Discussion**

269 *4.1 Main findings*

270 Ours is one of the first studies to explore children's psychological symptoms and their
271 correlates during the COVID-19 epidemic and associated lockdown. Overall, when
272 adjusting on age and sex, children's emotional difficulties and symptoms of
273 hyperactivity/inattention were significantly associated with their sleeping difficulties and
274 screen time exposure, their parents' symptoms of anxiety or depression and financial
275 difficulties. Parental employment situation was associated with children's symptoms of
276 hyperactivity/inattention only, in an age and sex-adjusted model. Overall, children's
277 symptoms of frequent psychological difficulties are associated with known risk factors of
278 youth mental health problems. Children of parents who have psychological difficulties or
279 who experience socioeconomic difficulties should benefit from special attention from
280 primary and mental health practitioners.

281 *4.2 Interpretation of study findings*

282 We discuss our findings on the role of parents' mental health and socioeconomic
283 characteristics on the one side, and children's sleep disorders and screen time use on the
284 other side.

285 *4.2.1 Parents' characteristics*

286 In accordance with previous research [31-33], parents' symptoms of anxiety or depression

287 during lockdown, as well as parents' preexisting mental health difficulties, were associated
288 with a higher level of children's emotional difficulties and symptoms of
289 hyperactivity/inattention.

290 In a stressful period such as the COVID-19 epidemic and resulting disruptions of daily life,
291 parents are the best resource for children to seek help from. Good parenting skills are
292 hence crucial when children are confined at home [1]. In general, children with a mentally
293 ill parent more frequently experience negative emotions, including anger, fear, and
294 sadness. They also show higher levels of disturbed attachment and difficulties in emotional
295 regulation [34]. Consequently, they are at elevated risk of internalizing problems, such as
296 depression and anxiety [15, 16].

297 Concerning children's symptoms of hyperactivity/inattention, the study of Zhang [9]
298 showed that they were related to parent's mood during the COVID-19 outbreak in China.
299 Additionally, parents of children with ADHD experience high levels of daily child-rearing
300 stressors [35, 36], therefore this association may also be bidirectional. The special
301 combination of school closures and children staying at home might bring elevated
302 difficulties and stress for both children and their parents. Our results have significant
303 clinical implications concerning the importance of assessing parents' negative mood when
304 evaluating children's well-being. During periods of lockdown, when assessing a child,
305 mental health practitioners should pay further attention to the mental health status of the
306 parents, especially looking for depression or anxiety symptoms.

307 Similarly, independently of home confinement, previous research has reported that
308 children of parents with substance use disorders, [37-39], have an elevated likelihood of
309 additional mental disorders. However, we found no relationship between parental
310 consumption of tobacco or alcohol and offspring psychological difficulties. This may reflect

311 low rates of tobacco and alcohol use among TEMPO cohort participants. [40]

312 In our study, having a parent who presented with symptoms of COVID-19 was not
313 associated with a higher score of emotional difficulties or hyperactivity/inattention. In a
314 recent Chinese study [31], having relatives or acquaintances infected with COVID19 was
315 an independent risk factor of anxiety among college students, probably due to the high
316 contagiousness of the illness [41]. It is important to note that parental COVID-19
317 symptoms were self-reported since biological testing was hardly available during the
318 lockdown. It may also be that individuals who were too ill were not able to respond to
319 TEMPO study questionnaires.

320 Parental financial difficulties and work situation were associated with children's emotional
321 difficulties and symptoms of hyperactivity/inattention. Stability of family income has been
322 found to be significantly associated with youth anxiety during the COVID 19 crisis, due to
323 links with psychological and economic pressure [31, 42].

324 Our findings indicate an increased risk of psychological difficulties in children whose family
325 had psychological or financial difficulties during lockdown. This result is consistent with
326 previous studies, which demonstrated that parents with financial difficulties are at higher
327 risk of mental health difficulties such as anxiety. Economic decline [43] is associated with
328 increased mental health problems for youths that may be affected by its consequences on
329 adult unemployment and mental health, such as depression [14, 44].

330 *4.2.2 Children's characteristics*

331 Children's elevated levels of emotional difficulties and symptoms of
332 hyperactivity/inattention were associated with sleeping difficulties. Because both were
333 measured simultaneously, it is possible that these relationships are bidirectional. Children

334 who are anxious or experience symptoms of depression frequently have sleeping
335 problems, which sometimes appear as a key symptom of distress [18, 45]. Symptoms of
336 hyperactivity and inattention are core symptoms of ADHD. Similarly, ADHD may disrupt
337 sleep by increasing the probability of bedtime struggles or resistance, limit-setting sleep
338 problems, inadequate sleep hygiene, and insufficient sleep disorder or poor sleep quality.
339 In turn, sleep problems may result in ADHD-like day-time behaviors [46].

340 In the specific context of COVID-19, Zhang et al [9] showed that children who have ADHD
341 and experience low overall mood are most likely to see their symptoms of ADHD, including
342 sleep patterns, worsen. Another study [13] found that poor sleep, including nightmares, is
343 among the most frequently reported children's conditions during the COVID-19 outbreak.

344 In our study, children with emotional difficulties or symptoms of hyperactivity/inattention
345 spent more time in front of a screen during the COVID19 outbreak than children without
346 such symptoms, which is line with previous studies showing that increased screen time
347 may exacerbate risk for depression, anxiety, suicide, and inattention among children and
348 adolescents [47]. Excessive screen time may also be associated with health risks including
349 poor sleep and sedentarity, which further exacerbate risk of children's psychological diffi-
350 culties [48, 49]. It is however important to note that our study being cross-sectional, screen
351 use may also be a consequence of children's psychological difficulties, both potentially
352 reinforcing one another. Kiraly et al [50] made some practical guidance to prevent chil-
353 dren's problematic Internet use and emphasize that monitoring and regulating screen time
354 is crucial and can be implemented by involving young people in rule-making [51].

355 Paradoxically, during the COVID-19 pandemic, many mental health educational resources
356 and support services were offered via online platforms, which required screen use. Obvi-
357 ously, screen time may become over-present during periods of school closure [48], and

existing guidelines need to be adequately updated to remain relevant. A recent literature review emphasized that not all screen time is equal - e.g. doing online lessons for school is different from social media use, which is different from video games. [52]

4.3 Strengths and limitations

Our study's main strengths are that it was conducted in the community and started prior to the COVID-19 epidemic, making it possible to control for preexisting risk factors. However, it also has some limitations that need to be highlighted. First, all measures were based on self-reports, including the children's SDQ scores, which could have been influenced by parental emotional state [53]. Still, parental evaluations are appropriate given the young mean age of surveyed children (i.e. 6 years). Importantly, the performance and validity of the parent-reported SDQ in French [25] suggests that it is a good approximation of a psychiatric interview, in studies of population representative samples [54-56]. Second, we did not assess children's emotional difficulties and hyperactivity/inattention before the COVID-19 epidemic, so we have no information concerning pre-existing vulnerabilities. Children who experienced psychological difficulties prior to the pandemic or had pre-existing mental health problems are at high risk of having symptoms of anxiety [57]. Third, though some variables were assessed longitudinally on a weekly basis during lockdown, the causal relationship between children's and parents' characteristics and children's emotional difficulties or symptoms of hyperactivity/inattention cannot be confirmed as children's symptoms were assessed only once. A recent study [58] outlined the need for longitudinal mental health research with children during and after lockdown. Fourth, the relatively small sample of the study limited the statistical power of some analyses. This suggests that a larger sample may show evidence of other risk factors of children's

382 psychological difficulties. Fifth, participants were more likely to live with a partner, have
383 higher education and hold a managerial position than middle-aged adults of the same age
384 in France. Reassuringly, we observed a similar rate of lifetime unemployment compared to
385 the general population [17, 59]. Overall, associations between parental mental health and
386 socio-economic characteristics, as well as children's sleep and screen use, may actually
387 be stronger than we report. Sixth, children's age range was limited, as the study did not
388 include many very young or adolescent children. However, a focus on pre-teenagers made
389 it possible for us to study a coherent demographic group. **Seventh, our measure of**
390 **children's emotional and behavioural difficulties was dichotomized, which may have limited**
391 **the statistical power of our analyses, however we used a validated cut-off, and were thus**
392 **able to identify children with potentially clinically relevant psychological difficulties.**

393

394 *4.4 Implications*

395 The aim of our study was to assess family and individual risk factors of children's
396 symptoms of emotional difficulties and hyperactivity/inattention in a community-based
397 sample in France.

398 While the COVID19 pandemic is spreading all over the world, attention is mostly focused
399 on adults, hiding the public mental health burden in children. Our results underline the ne-
400 cessity to consider long-term mental health effects on this worldwide situation on children,
401 who account for 42% of the world's population. [60].

402 Risk factors of children's mental health difficulties identified in our study, which have previ-
403 ously been reported, may require special monitoring during the time of the pandemic. For
404 instance, paying attention to sleep difficulties and nightmares, and suggesting sleep hy-

405 giene and relaxation methods, could be especially worthwhile during the epidemic [13].

406 Moreover, screen time guidelines need to updated, as many children and adolescents will
407 not attend school.

408 Further longitudinal studies should be conducted in order to test prospective risk factors of
409 children's mental health difficulties. Indeed, even as restrictions are lifted and schools re-
410 open, the psychological impact of the pandemic will last. Increased awareness of the risk
411 factors of mental health difficulties in children in this unprecedented event is needed to
412 prevent them in the short and long terms.

413

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416

References

- 419 1. Wang G, Zhang Y, Zhao J, et al (2020) Mitigate the effects of home confinement on children during the
420 COVID-19 outbreak. *Lancet* 395:945–947. doi: 10.1016/S0140-6736(20)30547-X
- 421 2. Tang S, Xiang M, Cheung T, Xiang Y-T (2021) Mental health and its correlates among children and ado-
422 lescents during COVID-19 school closure: The importance of parent-child discussion. *J Affect Disord*
423 279:353–360. doi: 10.1016/j.jad.2020.10.016
- 424 3. Viner RM, Russell SJ, Croker H, et al (2020) School closure and management practices during coronavirus
425 outbreaks including COVID-19: a rapid systematic review. *Lancet Child Adolesc Health* 4:397–404. doi:
426 10.1016/S2352-4642(20)30095-X
- 427 4. Brazendale K, Beets MW, Weaver RG, et al (2017) Understanding differences between summer vs. school
428 obesogenic behaviors of children: the structured days hypothesis. *Int J Behav Nutr Phys Act* 14:100. doi:
429 10.1186/s12966-017-0555-2
- 430 5. Mahajan C, Kapoor I, Prabhakar H (2020) Psychological effects of Corona Virus Disease (COVID 19) on
431 children of Health Care Workers. *Anesth Analg*. doi: 10.1213/ANE.0000000000005034
- 432 6. Brooks SK, Webster RK, Smith LE, et al (2020) The psychological impact of quarantine and how to reduce
433 it: rapid review of the evidence. *Lancet* 395:912–920. doi: 10.1016/S0140-6736(20)30460-8
- 434 7. Martinelli M, Strisciuglio C, Fedele F, et al (2020) Clinical and Psychological Issues in Children with In-
435 flammatory Bowel Disease During COVID-19 Pandemic. *Inflamm Bowel Dis*. doi: 10.1093/ibd/izaa136
- 436 8. Bobo E, Lin L, Acquaviva E, et al (2020) [How do children and adolescents with Attention Deficit Hyper-
437 activity Disorder (ADHD) experience lockdown during the COVID-19 outbreak?]. *Encephale*. doi:
438 10.1016/j.encep.2020.05.011
- 439 9. Zhang J, Shuai L, Yu H, et al (2020) Acute stress, behavioural symptoms and mood states among school-
440 age children with attention-deficit/hyperactive disorder during the COVID-19 outbreak. *Asian J Psychiatr*
441 51:102077. doi: 10.1016/j.ajp.2020.102077
- 442 10. Fegert JM, Vitiello B, Plener PL, Clemens V (2020) Challenges and burden of the Coronavirus 2019
443 (COVID-19) pandemic for child and adolescent mental health: a narrative review to highlight clinical and
444 research needs in the acute phase and the long return to normality. *Child Adolesc Psychiatry Ment Health*
445 14:20. doi: 10.1186/s13034-020-00329-3
- 446 11. Xie X, Xue Q, Zhou Y, et al (2020) Mental Health Status Among Children in Home Confinement During
447 the Coronavirus Disease 2019 Outbreak in Hubei Province, China. *JAMA Pediatr*. doi:
448 10.1001/jamapediatrics.2020.1619
- 449 12. Liang L, Ren H, Cao R, et al (2020) The Effect of COVID-19 on Youth Mental Health. *Psychiatr Q*
450 91:841–852. doi: 10.1007/s11126-020-09744-3
- 451 13. Jiao WY, Wang LN, Liu J, et al (2020) Behavioral and Emotional Disorders in Children during the COVID-
452 19 Epidemic. *The Journal of Pediatrics* 221:264–266.e1. doi: 10.1016/j.jpeds.2020.03.013
- 453 14. Golberstein E, Wen H, Miller BF (2020) Coronavirus Disease 2019 (COVID-19) and Mental Health for

- 454 Children and Adolescents. JAMA Pediatr. doi: 10.1001/jamapediatrics.2020.1456
- 455 15. Merikangas KR, Dierker LC, Szatmari P (1998) Psychopathology among offspring of parents with sub-
456 stance abuse and/or anxiety disorders: a high-risk study. J Child Psychol Psychiatry 39:711–720.
- 457 16. Weissman MM, Wickramaratne P, Gamberoff MJ, et al (2016) Offspring of Depressed Parents: 30 Years
458 Later. Am J Psychiatry 173:1024–1032. doi: 10.1176/appi.ajp.2016.15101327
- 459 17. Melchior M, Chastang J-F, Walburg V, et al (2010) Family income and youths' symptoms of depression and
460 anxiety: a longitudinal study of the French GAZEL Youth cohort. Depress Anxiety 27:1095–1103. doi:
461 10.1002/da.20761
- 462 18. Yap MBH, Jorm AF (2015) Parental factors associated with childhood anxiety, depression, and internaliz-
463 ing problems: A systematic review and meta-analysis. J Affect Disord 175:424–440. doi:
464 10.1016/j.jad.2015.01.050
- 465 19. Redonnet B, Chollet A, Fombonne E, et al (2012) Tobacco, alcohol, cannabis and other illegal drug use
466 among young adults: The socioeconomic context. Drug Alcohol Depend 121:231–239. doi:
467 10.1016/j.drugalcdep.2011.09.002
- 468 20. Nabi H, Limosin FDR, Zins M, et al Personality and the risk of cancer: a 16-year follow-up study of the
469 GAZEL cohort. hal.archives-ouvertes.fr
- 470
- 471 21. Fombonne E, Vermeersch S (1997) Les enfants de la cohorte GAZEL: I-Prévalence des contacts avec le
472 système médico-éducatif pour des motifs psychologiques, et facteurs associés. Revue d'épidémiologie et de
473 santé ...
- 474 22. Melchior M, Chollet A, Elidemir G, et al (2015) Unemployment and Substance Use in Young Adults: Does
475 Educational Attainment Modify the Association? Eur Addict Res 21:115–123. doi: 10.1159/000365887
- 476 23. Goodman R (2001) Psychometric properties of the strengths and difficulties questionnaire. Journal of the
477 American Academy of Child & Adolescent Psychiatry 40:1337–1345.
- 478 24. Goodman A, Goodman R (2009) Strengths and Difficulties Questionnaire as a Dimensional Measure of
479 Child Mental Health. Journal of the American Academy of Child & Adolescent Psychiatry 48:400–403. doi:
480 10.1097/CHI.0b013e3181985068
- 481 25. Shojaei T, Wazana A, Pitrou I, Kovess V (2009) The strengths and difficulties questionnaire: validation
482 study in French school-aged children and cross-cultural comparisons. Soc Psychiatry Psychiatr Epidemiol
483 44:740–747. doi: 10.1007/s00127-008-0489-8
- 484 26. Kessler RC, Adler L, Ames M, et al (2005) The World Health Organization adult ADHD self-report scale
485 (ASRS): a short screening scale for use in the general population. Psychol Med 35:245–256. doi:
486 10.1017/S0033291704002892
- 487 27. Bush K, Kivlahan DR, McDonell MB, et al (1998) The AUDIT alcohol consumption questions (AUDIT-C)
488 - An effective brief screening test for problem drinking. Arch Intern Med 158:1789–1795.
- 489 28. Gache P, Michaud P, Landry U, et al (2005) The Alcohol Use Disorders Identification Test (AUDIT) as a
490 screening tool for excessive drinking in primary care: Reliability and validity of a French version. Alcohol-
491 ism-Clinical and Experimental Research 29:2001–2007. doi: 10.1097/01.alc.0000187034.58955.64
- 492 29. BOHN MJ, BABOR TF, KRANZLER HR (1995) The Alcohol-Use Disorders Identification Test (Audit) -
493 Validation of a Screening Instrument for Use in Medical Settings. J Stud Alcohol 56:423–432.
- 494 30. (2002) The Alcohol Use Disorders Identification Test. 1–41.

- 495 31. Cao W, Fang Z, Hou G, et al (2020) The psychological impact of the COVID-19 epidemic on college stu-
496 dents in China. *Psychiatry Res* 287:112934. doi: 10.1016/j.psychres.2020.112934
- 497 32. Woodgate RL, Tailor K, Tennent P, et al (2020) The experience of the self in Canadian youth living with
498 anxiety: A qualitative study. *PLoS ONE* 15:e0228193. doi: 10.1371/journal.pone.0228193
- 499 33. Gentili D, Bardin A, Ros E, et al (2020) Impact of Communication Measures Implemented During a School
500 Tuberculosis Outbreak on Risk Perception among Parents and School Staff, Italy, 2019. *Int J Environ Res*
501 *Public Health*. doi: 10.3390/ijerph17030911
- 502 34. Schechter DS, Willheim E (2009) Disturbances of attachment and parental psychopathology in early child-
503 hood. *Child Adolesc Psychiatr Clin N Am* 18:665–686. doi: 10.1016/j.chc.2009.03.001
- 504 35. Pelham WE, Lang AR (1999) Can your children drive you to drink? Stress and parenting in adults interact-
505 ing with children with ADHD. *Alcohol Res Health* 23:292–298.
- 506 36. Yousefia S, Far AS, Abdollahian E (2011) Parenting stress and parenting styles in mothers of ADHD with
507 mothers of normal children. The Effect of Information Technology in the Entrepreneurship (A Case Study
508 in Golestan Province IRAN) 30:1666–1671. doi: 10.1016/j.sbspro.2011.10.323
- 509 37. Riley AW, Valdez CR, Barrueco S, et al (2008) Development of a family-based program to reduce risk and
510 promote resilience among families affected by maternal depression: theoretical basis and program descrip-
511 tion. *Clin Child Fam Psychol Rev* 11:12–29. doi: 10.1007/s10567-008-0030-3
- 512 38. Bosanac P, Buist A, Burrows G (2003) Motherhood and schizophrenic illnesses: a review of the literature.
513 *Aust N Z J Psychiatry* 37:24–30. doi: 10.1046/j.1440-1614.2003.01104.x
- 514 39. Rasic D, Hajek T, Alda M, Uher R (2014) Risk of mental illness in offspring of parents with schizophrenia,
515 bipolar disorder, and major depressive disorder: a meta-analysis of family high-risk studies. *Schizophr Bull*
516 40:28–38. doi: 10.1093/schbul/sbt114
- 517 40. Galéra C, Pingault J-B, Fombonne E, et al (2013) Attention problems in childhood and adult substance use.
518 *The Journal of Pediatrics* 163:1677–1683.e1. doi: 10.1016/j.jpeds.2013.07.008
- 519 41. Song Z, Xu Y, Bao L, et al (2019) From SARS to MERS, Thrusting Coronaviruses into the Spotlight. *Vi-*
520 *rus*. doi: 10.3390/v11010059
- 521 42. Liu JJ, Bao Y, Huang X, et al (2020) Mental health considerations for children quarantined because of
522 COVID-19. *Lancet Child Adolesc Health* 4:347–349. doi: 10.1016/S2352-4642(20)30096-1
- 523 43. Catalano R, Goldman-Mellor S, Saxton K, et al (2011) The health effects of economic decline. *Annu Rev*
524 *Public Health* 32:431–450. doi: 10.1146/annurev-publhealth-031210-101146
- 525 44. Golberstein E, Gonzales G, Meara E (2019) How do economic downturns affect the mental health of chil-
526 dren? Evidence from the National Health Interview Survey. *Health Econ* 28:955–970. doi:
527 10.1002/hec.3885
- 528 45. Alfano CA, Zakem AH, Costa NM, et al (2009) Sleep Problems and Their Relation to Cognitive Factors,
529 Anxiety, and Depressive Symptoms in Children and Adolescents. *Depress Anxiety* 26:503–512. doi:
530 10.1002/da.20443
- 531 46. Yurumez E, Kilic BG (2016) Relationship Between Sleep Problems and Quality of Life in Children With
532 ADHD. *J Atten Disord* 20:34–40. doi: 10.1177/1087054713479666
- 533 47. Maras D, Flament MF, Murray M, et al (2015) Screen time is associated with depression and anxiety in
534 Canadian youth. *Prev Med* 73:133–138. doi: 10.1016/j.ypmed.2015.01.029
- 535 48. Nagata JM, Abdel Magid HS, Gabriel KP (2020) Screen time for children and adolescents during the
536 COVID-19 pandemic. *Obesity (Silver Spring)*. doi: 10.1002/oby.22917

537 49. Lissak G (2018) Adverse physiological and psychological effects of screen time on children and adoles-
538 cents: Literature review and case study. *Environ Res* 164:149–157. doi: 10.1016/j.envres.2018.01.015

539 50. Király O, Potenza MN, Stein DJ, et al (2020) Preventing problematic internet use during the COVID-19
540 pandemic: Consensus guidance. *Compr Psychiatry* 100:152180. doi: 10.1016/j.comppsy.2020.152180

541 51. Bjelland M, Soenens B, Bere E, et al (2015) Associations between parental rules, style of communication
542 and children's screen time. *BMC Public Health*. doi: 10.1186/s12889-015-2337-6

543 52. Orben A (2020) Teenagers, screens and social media: a narrative review of reviews and key studies. *Soc*
544 *Psychiatry Psychiatr Epidemiol* 55:407–414. doi: 10.1007/s00127-019-01825-4

545 53. Neugebauer R, Ng S (1990) Differential recall as a source of bias in epidemiologic research. *J Clin*
546 *Epidemiol* 43:1337–1341.

547 54. Mathai J, Anderson P, Bourne A (2004) Comparing psychiatric diagnoses generated by the Strengths and
548 Difficulties Questionnaire with diagnoses made by clinicians. *Aust N Z J Psychiatry* 38:639–643. doi:
549 10.1080/j.1440-1614.2004.01428.x

550 55. Costello EJ, Foley DL, Angold A (2006) 10-year research update review: The epidemiology of child and
551 adolescent psychiatric disorders: II. Developmental epidemiology. *Journal of the American Academy of*
552 *Child & Adolescent Psychiatry* 45:8–25. doi: 10.1097/01.chi.0000184929.41423.c0

553 56. Goodman R, Ford T, Simmons H, et al (2000) Using the Strengths and Difficulties Questionnaire (SDQ) to
554 screen for child psychiatric disorders in a community sample. *The British Journal of Psychiatry* 177:534–
555 539. doi: 10.1192/bjp.177.6.534

556 57. Duffy KA, McLaughlin KA, Green PA (2018) Early life adversity and health-risk behaviors: proposed
557 psychological and neural mechanisms. *Annals of the New York Academy of Sciences* 1428:151–169. doi:
558 10.1111/nyas.13928

559 58. Wade M, Prime H, Browne DT (2020) Why we need longitudinal mental health research with children and
560 youth during (and after) the COVID-19 pandemic. *Psychiatry Res* 290:113143. doi:
561 10.1016/j.psychres.2020.113143

562 59. Aljandaleh H, Bolze C, El-Khoury Lesueur F, et al (2020) Factors Associated with Electronic Cigarette Use
563 among Young Adults: The French “Trajectoires EpidéMiologiques en POpulation” (TEMPO) Cohort
564 Study. *Subst Use Misuse* 55:964–972. doi: 10.1080/10826084.2020.1717534

565 60. Dalton L, Rapa E, Stein A (2020) Protecting the psychological health of children through effective commu-
566 nication about COVID-19. *Lancet Child Adolesc Health* 4:346–347. doi: 10.1016/S2352-4642(20)30097-3

567 61. American Academy of Pediatrics Announces New Recommendations for Children's Media Use. [APA.org](https://www.apa.org)

568 62. INSEE: Revenu disponible par ménage (moyenne et médiane).
569 http://www.insee.fr/fr/themes/tableau.asp?reg_id=0&ref_id=NATSOS04202.

570 63. Agence nationale de santé publique". www.santepubliquefrance.fr