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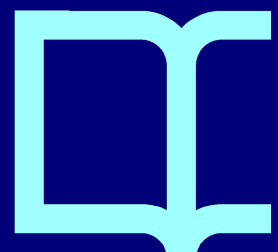
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1 **UNDERSTANDING THE RELATIONSHIP BETWEEN GENDER AND MENTAL HEALTH IN**
2 **ADOLESCENCE: THE GENDER ADHERENCE INDEX (GAI)**

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44 **Abstract**

45 **Introduction**

46 Half of all mental health disorders appear during adolescence, although it is still far from
47 clear how they relate to gender (not sex) criteria. This study aims both to analyse the
48 relationship between gender and adolescent mental health and to propose an index: the
49 Gender Adherence Index (GAI).

50 **Methods**

51 We used cross-sectional, secondary data from 3888 adolescents (aged 13-19) from the
52 FRESC Health Survey on Adolescence in Barcelona. We analysed the interaction among
53 sex, age and socio-economic status with several mental health indices. Additionally, we
54 computed a gender adherence index (GAI) to transcend the information-poor binary sex
55 label and thus assess to what extent mental health can be predicted by the gender
56 expression of adolescents irrespective of their biological sex.

57 **Results**

58 We found that older age and lower economic status have a greater impact on the
59 emotional distress of girls, who reported lower self-perceived mental health than boys.
60 Nevertheless, girls obtained higher scores regarding their prosocial behaviour, which is
61 protective against mental health problems. The GAI was retained in all statistical models
62 stressing it as a relevant metric to explain the variability of adolescent emotional distress.
63 Young people who showed adherence to normative femininity in their lifestyles showed
64 higher prosocial behaviour but did not tend to present more emotional distress.

65 **Conclusion**

66 Despite its limitations, this is a novel attempt to explore the relationship between gender
67 expression and mental health. Better defined indices of gender adherence could help us
68 to improve our predictive capacity of mental health disorders during adolescence.

69 Keywords: gender; mental health, adolescence, gender expression, biological sex.

70

71 **1. Introduction**

72 A substantial proportion of adolescents (13-25%) fulfil psychiatric diagnosis criteria at some
73 point in their life [1,2]. According to the European Society for Child and Adolescent Psychiatry
74 (ESCAP) half of psychiatric disorders appear for the first time before 14 years of age and more
75 than 70% before 18 years of age [3]. The problem is compounded by the fact that young
76 people with emotional distress, and even frank depression and anxiety, tend to avoid health
77 services [4-7] following a pattern also existing among the adult population [8], but in this case
78 more intensified [9-10]. Boys with emotional distress avoid health services more than girls
79 and show fewer prosocial lay coping strategies [11].

80 Differences based on sex and gender construction in mental disorders are among the
81 most intriguing and stable findings in psychiatry [12]. Decades after Rubin's definition [13] of
82 the sex/gender system by which a society transforms biology into a social and cultural
83 construct, we know that this idea falls short and at least two elements are problematic. First,
84 sex is not an impermeable or pre-existing dimension in the culture, quite the opposite; we
85 can understand it as a set of characteristics which are read and even produced culturally. As
86 Butler [14] says, sex has really always been gender. Second, there is confusion between sex
87 and gender in the way many public health studies codify health and the variables determining
88 it. In most cases, they use sex as the only proximal variable of the complex process that gender
89 involves, merging gender identity and gender expression into a single binary question. In this
90 way, it is concentrated or synthesized in a single categorical and binary manner, and
91 therefore, a great deal of interesting data is lost.

92 There are examples of questionnaires, scales, and statistical tools which opt to analyse
93 the complexity of the gender variable by focusing on the expression of gender, studying it as
94 a continuum and without falling into binary simplifications (sex=gender), such as the

95 pioneering Sex Role Inventory (SEI) [15], the Conformity to Masculine Norms Inventory
96 (CMNI) [16] and Traditional Masculinity and Femininity (TMF) [17], to name just a few of both
97 the oldest and the most up-to-date examples. However, we do not find studies using these
98 types of scales in the field of youth health and/or mental health. This study aims to contribute
99 towards the generation of richer indicators on gender expression, which will allow us to better
100 understand and delimit those elements affecting the mental health of the adolescent
101 population which come from the culture and can therefore be modified or adapted via
102 interventions elaborated from self-perceived information. In short, this article aims to provide
103 new data to analyse the relationship between gender expression and mental health (degree
104 of suffering and ways of expressing it) among the adolescent population. The proposal is the
105 Gender Adherence Index (GAI), based on a multivariate analysis of social behaviours and
106 habits and beliefs associated with gender. This Index, measured using variables taken from
107 the Risk Factors in Secondary School Students (FRESC) questionnaire, seeks to analyse the
108 relationship between the gender expression of adolescents and their mental health. The aim
109 is to focus on gender expression (set of practices, attitudes, habits and beliefs) and not on sex
110 (biological dimension) or gender identity (how a person defines themselves in relation to their
111 gender assignment). The general hypothesis is that gender expression, as a socialising
112 process, influences the level and forms of expressing mental distress among adolescents and
113 therefore it conditions the processes of formal and informal care-seeking [18-20]. We
114 consider two initial hypotheses:

115 (H1) There is a significant relationship between sex, age and economic status and self-
116 perceived health, mental well-being and the feeling of despair and therefore the
117 probability of presenting mental health problems [21-22]. In this relationship, being a

118 girl, being older and having lower economic status would partly explain an increase in
119 the mental suffering expressed.

120 (H2) Gender conditions the forms of expressing distress, but also the forms of help-
121 seeking [18-20]. For the general population it is known that women tend to report
122 more internalizing disorders, whereas men tend to report more externalizing
123 disorders. Accordingly, an adolescent identified as a girl present greater probability of
124 suffering from emotional problems and higher scoring in prosocial behaviour. In
125 contrast, an adolescent identified as a boy will present a greater probability of
126 suffering behaviour-related problems, symptoms associated with hyperactivity-
127 attention deficits and problems with peers. These variables will interact with others,
128 such as age and economic status.

129 In a nutshell, the sex binary label may fall short for the understanding of the relationships
130 between mental health and gender, and other metrics or indices might be necessary to
131 complement and ultimately improve our understanding of how the hegemonic masculinity
132 and femininity models have an impact on the mental health of adolescents and young people.

133

134 **2. Materials and methods**

135 *2.1. Participants and data*

136 We used data from the FRESC Survey carried out by the Barcelona Public Health Agency
137 during 2016 [23], resulting in a sample size of 3,888 adolescents aged 13–19. Specifically, the
138 sample (individuals who received and answered the questionnaire) consisted of a) 1,112 2nd-
139 year students (13 to 15 years old) from public secondary schools; b) 1,013 4th-year students
140 (15 to 17 years old) from the same schools as in a); c) 903 pre-university course students (17
141 to 19 years old); and d) 383 professional training students (17 to 19 years old).

142 The FRES survey contains three basic socio-demographic variables (binary sex, age,
143 and economic status) along with several well-being and mental health indicators and scales,
144 such as health self-perception - measured on a 5-point Likert-type ordinal scale response -,
145 level of despair - binary response (yes or no) on whether the participant has felt despair
146 during the last 12 months - , the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) and
147 the Strengths and Difficulties Questionnaire (SDQ).

148 The WEMWBS allows the measurement of positive aspects of mental health during
149 the last two weeks before the survey, with higher values denoting higher levels of mental
150 wellness [24] (see supplementary material for further details). The SDQ is a brief
151 questionnaire (25 items, 3-option Likert scale and a score from 0 to 40) that can be
152 administered to the parents and teachers of 4–16 year olds and to 11–16 year olds
153 themselves. The algorithm makes separate predictions for three groups of disorders, namely
154 conduct-oppositional disorders, hyperactivity-inattention disorders, and anxiety-depressive
155 disorders. Each is predicted to be unlikely, possible, or probable. It is divided in five subscales
156 that assess: i) general discomfort, ii) emotional symptoms, iii) behavioural problems and
157 hyperactivity, iv) peer relation issues, and v) prosocial attitude. The first four subscales are
158 interpreted as difficulties, while the last is defined as a strength. It is a reliable index that has
159 also been cross-culturally validated, also in the Spanish specific context [25-27] (see
160 supplementary methods in the appendix for further details).

161

162 *2.2. Data analysis*

163 We explored the relationships between all mental health variables and the sex factor. We
164 thus tested for potential mental health disparities associated with the binary sex
165 determination. In these analyses we also included age and economic status as covariates

166 since both can interact with the sex factor and have consequences on the mental health of
167 adolescents. The response variables analysed were health self-perception, level of despair,
168 the WEMWBS, and the SDQ (the total score and the 5 subscales). For each of these variables
169 we built fully saturated general or generalized linear models (GLMs), i.e., including the three
170 covariates (sex, age and economic status) and all possible interactions between them. We
171 then selected the minimum adequate model for each variable by means of an automated
172 multi-model selection based on the Akaike information criterion (AIC), which assesses the
173 goodness of fit of the models by weighing their explanatory power against the number of
174 parameters included [28-29]. The statistical assumptions of the selected models as well as
175 their performance (e.g., residual distributions, heteroscedasticity, outliers and leverage) were
176 checked through diagnostic residual plots [28-29]. For the SDQ results we also conducted a
177 principal component analysis (PCA) in order to evaluate the distribution of each of the SDQ
178 components in relation to the sex factor and thereby detect potential biases that could help
179 us to interpret the results obtained by the linear models.

180 Additionally, we computed a Gender Adherence Index (GAI) to analyse the
181 relationships between the mental health of the adolescents and their behavioural patterns
182 and their gender socialization but irrespective of the sex determination or at least providing
183 a complement to this binary label. We would like to specify that by gender adherence we
184 refer to the normative gender assumed as a social construction in a given cultural context. To
185 do so, we carried out several PCAs, selecting those life-habit variables which showed a greater
186 sex-based segregation power of our sample population. We then progressively dropped out
187 those variables that did not add extra variability or explanatory power based on their small
188 eigenvalues, or additionally, because they produced statistical artefacts due to their poor
189 representation in the dataset (e.g., the use of contraceptive methods showed a strong sex-

190 based bias, but it could not be included due to the simple fact that it only had values for the
191 oldest age group).

192 Importantly, the goal of any PCA is to reduce the dimensionality of a multivariate
193 dataset into a low number of principal components or axes which capture the maximum
194 variability present in the observations. The visualization of the results of this PCA overlapping
195 the sex factor allowed us to determine which of these axes is the one most likely associated
196 with the gender expression and to therefore offer the highest potential for a GAI that is
197 operational for the FRESC data. We then validated this observed sex-related disparity in the
198 scores of this axis, and afterwards we assessed its explanatory power over the emotional and
199 prosocial components of the SDQ, which were previously detected to present a higher sex
200 bias. This was done following a similar automated model selection procedure but this time
201 including the GAI score of each participant as another covariate that may add extra
202 information not captured by the binary sex factor. Finally, we assessed the performance of all
203 the best minimum models based on their AIC and calculated their determination coefficients
204 (i.e., their percentage of explained variation or R^2) to compare their explanatory power when
205 including or not the GAI metric.

206 All the statistical analyses were done with the R v 3.5.1 programming environment
207 [30], the linear models and the automatic selection procedures were carried out with the
208 statistical packages lme4 [31] and MuMIn [32], respectively, while all data exploration and
209 visualization were done with the package ggplot2 [33].

210

211 **3. Results**

212 *3.1. Regarding Hypothesis 1: Sex and mental health*

213 According to our GLMs, sex was a strong and significant explanatory factor with regard to the

214 level of self-perceived health among adolescents. Girls showed statistically significant higher
215 values of health self-perception, which actually denote a worse self-perceived health ($0.15 \pm$
216 0.02 , $p < 0.001$, see Table 1 and Figure 1A; all numbers are effect estimates \pm standard error
217 of the estimate hereafter). The effect of age and socio-economic status were also significant,
218 resulting in lower self-perceived health as age increases (0.02 ± 0.01 , $p < 0.001$), while a higher
219 socioeconomic status was related to better self-perceived health (-0.04 ± 0.01 , $p < 0.001$). The
220 sex variable also had the strongest effect size on mental well-being as measured according to
221 the WEMWBS, with girls scoring on average -3.28 ± 0.26 ($p < 0.001$) lower than boys (Table 1
222 and Figure 1B). The age and the economic status also had significant effects on mental well-
223 being (Table 1). As adolescents grew up their mental well-being decreased. And again, there
224 was a positive relationship between socio-economic status and the mental well-being of the
225 youth.

226

227 *3.2. Regarding Hypothesis 2: the gendered expression of distress*

228 Concerning the SDQ, we detected a significant interaction between sex and age in relation to
229 the total score and the emotional and behavioural components (Table 2). As girls grew up and
230 got nearer to 19 years old, they presented disproportionately higher degrees of mental
231 suffering mostly driven by emotional-type issues as compared with their male peers (Figures
232 2A and 2B). The lower the economic status, the lower the total score of the SDQ (-0.31 ± 0.06 ,
233 $P < 0.001$, Table 2) and therefore the greater the probability of developing emotional issues
234 (-0.11 ± 0.02 , $P < 0.001$, Table 2). It was in this subscale that measures emotional-type
235 problems where the effect of the second order interaction between sex and age was most
236 evident and most statistically consistent (0.14 ± 0.04 , $P < 0.001$, Table 2). As with total SDQ
237 scores, adolescent girls in comparison with boys obtained greater scores in the emotional

238 component of the SDQ index as they became older. In other words, this divergence by sex
239 appeared and became greater as adolescents grew up.

240 Girls showed higher prosocial scores than boys (0.66 ± 0.05 , $p < 0.001$, Table 2) but
241 irrespective of their age (Figure 2C). The interaction between sex and age was not significant
242 and thus it was dropped out from the model, although ageing did show a direct and positive
243 effect over the ability of adolescents to develop prosocial skills (0.07 ± 0.01 , $p < 0.001$, Table
244 2). We also detected a significant interaction between sex and age over behavioural SDQ
245 subscale (0.03 ± 0.01 , $p < 0.05$, Table 2). Lastly, we did not find statistically significant
246 relationships with other SDQ components such as those related with hyperactivity-attention
247 and relationships with peers.

248

249 3.3. *The Gender Adherence Index (GAI)*

250 By carrying out a PCA with the scores obtained in the different SDQ subscales and overlapping
251 a posteriori the sex of each respondent we could graphically see the general trends of sex-
252 biased patterns detected with our previous generalized linear models (Figure 3). The
253 expressions of mental suffering and the problems associated with the emotions and also the
254 prosocial skills of adolescents showed a clear segregation by sex (see vertical PCA axis in
255 Figure 3A, which captures 22.65% of the total variation). Specifically, the probability of
256 experiencing emotional-type problems correlated with presenting prosocial-type behaviours.
257 The values of both variables were significantly higher in girls both in previous models and also
258 in an additional GLM using the scores of the PC2 axis as a response variable and including sex,
259 age and economic status as explanatory factors (sex effect over girls: 0.69 ± 0.03 , $P < 0.001$,
260 Figure 3B).

261 This set of variables in a PCA showed a clear segregation by sex across the first axis
262 (Figure 4A). The most relevant variables by order of importance (i.e., their loading over the
263 first PCA axis) were: "Midweek video game hours"; "Weekend video game hours"; "Video
264 game hours before sleeping midweek"; "Front seatbelt"; "Rear seatbelt"; "Sexual
265 orientation"; "Beating"; "Mockery"; "Rejection"; "Hitting"; "Marginalization". These variables
266 respond to the hours and schedules devoted to video games by adolescents, their perception
267 of risk when travelling by car, their sexual orientation and violent relationships (carried out
268 and/or received) with peers, respectively. An adolescent self-identified as a girl may behave
269 aligned with her girl peers irrespective of her biological sex (see purple data point distribution
270 across the PC1 axis in Figure 4A). Thus, the score obtained for this PC1 axis provides an ad hoc
271 index of gender expression. In this case, higher values of the GAI denote a greater "adherence
272 to normative femininity" while lower values mean a greater "adherence to normative
273 masculinity". By analysing the behaviour of this GAI with a linear model equivalent to those
274 carried out previously, we could see that there was again a significant interaction between
275 sex and age (-0.12 ± 0.04 , $P < 0.01$, Figure 4B).

276 Finally, we re-analysed the data of the emotional and prosocial component of the SDQ,
277 in which we had found strong patterns of sex bias, but in this case adding the GAI as an
278 additional covariate to the initial saturated model. The unsupervised automatic model
279 selection process chose 8 and 9 GLMs for the emotional and prosocial components
280 respectively, which were roughly equivalent in regard to their goodness of fit to the data (i.e.,
281 with differences in their AIC lower than 2). Importantly, in all these selected models both the
282 sex factor and the GAI covariate were always retained, therefore showing their relevance
283 when it comes to explaining the variation of the scores obtained by the adolescent population
284 in each SDQ subscale. In the Table 3 we show the output of the most parsimonious models

285 (i.e., with the lowest AIC) for each of these SDQ components. The outputs of these models
286 largely reproduced the same results obtained in the previous GLMs (cf. emotional and
287 prosocial models in Tables 2 and 3), but the GAI appeared as a statistically significant covariate
288 for both components. For the emotional component, however, the effect of the GAI was
289 rather marginal (-0.06 ± 0.03 , $P < 0.05$). For the prosocial component the effect of the GAI was
290 stronger (0.11 ± 0.02 , $P < 0.001$) and indicated that the individuals who most closely stick to
291 a feminine normative pattern of behaviour (higher values in the GAI) showed a statistically
292 very significant trend towards developing prosocial behaviours.

293

294 **4 Discussion**

295 This study shows that both getting older (closer to 19) and having a low socio-economic status
296 have a negative impact on the self-perceived health and levels of mental suffering or
297 emotional well-being (despair, WEMWBS and SDQ) (H1) of young women. Studies like Rajmil
298 [27], carried out in Catalonia, find the same relationship between mental health (SDQ),
299 gender and socio-economic status, and others confirm this trend [34]. Worse mental health
300 or greater expressed mental suffering in people socialized female could be explained by two
301 motives. Firstly, it is the result of a sexist and patriarchal social system, where gender
302 inequalities and male violence against women have an especially bad effect on women and
303 this has an impact on their mental health (violence received, overload about care work,
304 devaluation of everything female-associated, etc.) [35-36]. Secondly, it generally has to do
305 with the capacity to express vulnerability and affliction on the part of girls, associated with
306 female socialization, generally much more highly developed than in people socialized male
307 [11,18].

308 Our study confirms the relationship between age and problems detected by the SDQ.
309 The older the individual, the more problems detected by the SDQ [37-38]. However, according
310 to Stratton et al. [39], regardless of gender, emotional-type disorders and prosocial behaviour
311 increase over the years and, on the contrary, behaviour and hyperactivity problems decrease
312 over the years.

313 Variables such as gender, age and socio-economic status also condition the forms of
314 expressing the problems studied. From our study, it has been possible to show that girls
315 present or express more emotional-type problems, especially as they grow older. Related to
316 the hypothesis that boys tend to express suffering through behavioural problems, there are
317 certain differences, especially at the younger ages, from which boys present higher scores in
318 this subscale (behaviour). This distance seems to diminish with age. This could lead us to think
319 that there are more girls who "masculinize" (in terms of normative and hegemonic gender)
320 their manner of expressing suffering than boys who "feminize" it. However, these results are
321 not consistent, and research would have to be extended to state it conclusively.

322 Our study is consistent with the hypothesis that girls, as a trend, present higher results
323 than boys where prosocial behaviour is concerned, irrespective of age and economic status.
324 These differences are significant throughout the entire sample, but as the years pass, the
325 prosocial behaviour of boys improves, and the differences diminish. These results partly
326 coincide with other studies based on the SDQ which determine that the effect of the (poorly
327 named) "sex" conditions the form of expressing mental suffering, but also marks the trend
328 regarding some of the so-called protective effects (e.g., prosocial behaviour). Girls obtain
329 higher scores in emotional problems and prosocial behaviour and boys in the subscales of
330 hyperactivity and behavioural problems [40-41,27]. This would coincide with a widely studied
331 trend in men of externalizing discomfort, while women internalize it [42-43]. In our study, we

332 found no significant differences in the field of hyperactivity and only slightly significant
333 differences in the field of behaviour. Yet we did find significant differences in the other
334 domains mentioned. That is, the difference between boys and girls in prosocial behaviour
335 scores, but above all the reduction of these differences as boys and girls get older, also
336 appears in other European studies based on the SDQ [44].

337 Lastly, the study has also enabled us to call into question the operability of the sex
338 variable. Generally, the scientific literature which has studied the relationship between
339 gender and mental health in our context has focused on a greater prevalence of mental
340 disorders in women [45], a result, as we said, of the violence and inequalities suffered by
341 women. Other authors, such as Prior [46], have placed in doubt these differences in
342 epidemiological terms, asking whether this difference is not really also due to a
343 pathologization of femininity and an invisibilization of the masculine discomforts as a result
344 of androcentric psychiatric knowledge. A long list of authors question the sex category and
345 the sex (biological)-gender (cultural) dichotomy (starting from Butler [14]; Fausto-Sterling
346 [47], among others) or try to focus their research on one of the dimensions that is contained
347 within an idea of gender (or even sex, in our case) that is poorly defined, confused and,
348 therefore, not very operational. These authors focus on the socialization of gender (male) and
349 its relationship with (mental) health [48-49]. But in general, most studies on adolescent health
350 and mental health are based on only one sex/gender variable – obtained from only one
351 question in the questionnaire – without developing an operational definition of sex or gender.
352 In our study, we have attempted to carry out this exercise with the calculation of our own
353 Gender Adherence Index (GAI) as we did not find any other scale to analyse gender expression
354 or gender identity in studies on adolescent mental health.

355 To carry out this exploratory exercise, we have selected that information contributed
356 by the data extracted from the report and which, according to the scientific literature, are
357 conditioned by the socialization of gender (at perceived and/or self-perceived level): there is
358 a relationship between gender and the form in which school abuse and violence take place
359 [51-54] which makes more boys than girls aggressors [55-56]. Although changes are taking
360 place as far as the so-called "digital gap" goes (again, we could say, due to a certain
361 masculinization in feminine practices), boys present a tendency to play video games for longer
362 hours than girls [57-58]. With regards to the consumption of alcohol and cannabis [59-60],
363 we also find trends conditioned by gender resulting in greater consumption by males.
364 Devotion to leisure activities also appears *gendered*, because of this socialization of gender in
365 which physical and sporting activities are practised more widely by men [61, 62]. As far as the
366 selection of variables regarding the use of the seatbelt from the GAI, we can explain it because
367 of the existing relationship between masculinity, lower risk perception, more use of motor
368 vehicles and more risky behaviour or accidents in people socialized male [63-64].

369 We do not aim to generalize or explain all the gender-related variation in mental
370 health issues by means of these limited set gender-biased variables, but we have selected for
371 our GAI variables that can be partially predicted from gender. The GAI index/score has been
372 relatively significant, although always less than sex, to explain mental suffering and well-
373 being. In Table 3 of the results, we see information about the multi-model selection with the
374 "best models", which were selected because of their explanatory power and their goodness
375 of fit to the data and, significantly, they all include the GAI as a decisive covariate. Although
376 the sex variable was always retained, we could see that the inclusion of this GAI also
377 moderately increases the explanatory power of the models. And, in fact, in the ranking of
378 explanatory variables, it was even placed above age and economic status.

379 Although this ad hoc GAI index made a significant contribution, we acknowledge that
380 its effect size was rather moderate and, in fact, it even presents some interpretative
381 challenges. For example, higher GAI values, which in principle should mean more female
382 behaviours, do not increase the scores in the subscale of emotional problems. On the other
383 hand, in other SDQ components, as is the case with prosocial behaviour, we do obtain the
384 expected behaviour from this index. This is very probably due to complex interactions
385 between this GAI and other factors such as its interaction with age (see Figure 4B) which
386 suggests that its performance may vary as adolescents grow and, of course, modify their life
387 habits and consequently the ways they express their gender. As boys grew older, they
388 presented higher scores on prosocial behaviour than those obtained during the early years of
389 adolescence and the differences with girls narrowed. Additionally, we cannot discard other
390 complex interaction between this particular GAI and economic status or even sex itself. A
391 detailed, deep study of these latent relationships between explanatory variables would
392 improve our interpretative capacity, and more importantly, it may help to properly design the
393 questions needed to improve a GAI.

394

395 *4.1. Strengths, limitations, and future directions*

396 The presented results contribute to a greater knowledge concerning the levels of mental
397 suffering of adolescents and the forms of expressing this suffering with regard to age, socio-
398 economic status and, above all, gender.

399 Clearly, the data we have available are insufficient to extract a powerful GAI. Probably,
400 our GAI does not overcome the sex variable for two main reasons. Firstly, because the
401 exercise to calculate an operative GAI has been carried out with raw data from a

402 questionnaire which was not designed for this objective. The Risk Factors in Secondary School
403 Students (FRESC) survey does not include gender expression scales such as the Sex Role
404 Inventory (SEI). Therefore, in this study we have extracted the criteria for creating GAI from
405 the survey data itself, which is a limitation of our research. Secondly, because the sex variable
406 (binary) maintains a circular relationship with the other gender dimensions. In other words,
407 the birth sex conditions the assignment of gender and therefore all the social and cultural
408 learning.

409 There are other limitations of our study related to the SDQ tool. Firstly, in this study, the
410 3-point Likert version of the SDQ has been used. However, the previous psychometric
411 literature indicates that a 5-option Likert answer format improves the reliability of the scores,
412 the obtaining of valid evidence and user satisfaction [65-67]. Secondly, few research projects
413 have studied the measurement invariance (MI) of SDQ [66, 26, 68, 69, among others], which
414 measures the capacity to transfer the psychometric properties or make them generalizable
415 through groups (gender, country, etc.), or even through time (different historical moments
416 and their conditions). Those who have studied it present contradictory results [70] and
417 therefore there are doubts about the applicability of the SDQ itself to different genders
418 without making any amendment. Lastly, the SDQ has been a very widely used and valued tool
419 due to its ease of application [71], but it is a questionnaire which inevitably involves a
420 simplification of the mental health suffering and problems of the adolescent population.

421 Methodologically, we have showed that it is possible to create tools capable of capturing
422 the complexity of this dimension. This could be done by adding new questions in the
423 questionnaires (related to reproductive work and the care load, relationships and affection,
424 hobbies, habits, etc.) or scales which allow the studying of gender in its complexity (for
425 example, CMNI, by Mahalik [16]) on the road to health and mental health. In this regard, we

426 have contributed data which place on the table the need to elaborate (or apply) specific tools
427 to analyse in a complex form all the dimensions of gender (sex, identity, expression of gender
428 and sexual preference) and place this information at the service of studies regarding the
429 health and mental health of the adolescent population.

430

431 **5 Conclusions**

432 Regarding Hypothesis 1, identifying as a woman, being older (between 13 and 19 years
433 old) and having a low economic status have a negative impact on self-perceived health and
434 the level of mental suffering or emotional well-being (despair, WEMWBS and SDQ) in
435 comparison with identifying as a man, being younger (between 13 and 19 years old) and
436 having a high socio-economic status.

437 Regarding Hypothesis 2, gender, age and socio-economic status also condition the
438 forms of expressing suffering or the problems studied. In this regard, people who live as
439 women present or express more emotional-type problems, especially as their age increases.
440 Finally, the hypothesis has been confirmed that girls present higher results with regard to
441 prosocial behaviour compared to boys, this behaviour being understood as a protective factor
442 against mental health problems according to the SDQ. These differences are significant during
443 all the ages studied, but as the years pass, the prosocial behaviour of boys improves and the
444 differences diminish.

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Table 1. Relationship between self-perceived health, mental well-being and level of despair and sex, age, and economic status.			
	Self-perceived health	Mental well-being	Level of despair
Intercept	0.64 ± 0.11***	54.95 ± 1.27***	-2.59 ± 0.39***
Sex (girl)	0.15 ± 0.02***	-3.28 ± 0.26***	0.83 ± 0.08***
Age	0.02 ± 0.01***	-0.41 ± 0.07***	0.12 ± 0.02***
Economic status	-0.04 ± 0.01***	0.98 ± 0.09***	-0.19 ± 0.03***

Note: FRESC survey dataset. Self-perceived health is a semi-quantitative variable ranging from 1 (very good) to 5 (very bad). Mental well-being corresponds to the Warwick-Edinburgh discrete scale that ranges from 14 to 70 with higher scores denoting better mental well-being. The level of despair is a binomial variable with 1 or 0 coding for answers yes or no to the question: Have you felt despair during the last 12 months? Relationships between these variables and the sex, age and economic status of the adolescents were analysed by means of general and generalized linear models. Intercept corresponds to the average of the reference group which are boys of the youngest age group and lowest economic status. Effect estimates along with their standard errors are shown for each factor with *** denoting statistically significant differences with the reference group with an associated *P-value* < 0.001.

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Table 2. Relationship between the total score in the Strengths and Difficulties Questionnaire (SDQ) and its emotional, prosocial and behavioural components with sex, age and economic status.

	Total	Emotional	Prosocial	Behavioural
Intercept	12.70 ± 1.01***	3.01 ± 0.43***	5.01 ± 0.25***	1.32 ± 0.15***
Sex (Girl)	-2.80 ± 1.35*	-0.67 ± 0.57	0.66 ± 0.05***	-0.53 ± 0.20**
Age	0.06 ± 0.06	0.02 ± 0.03	0.07 ± 0.01***	-0.02 ± 0.008**
Economic status	-0.31 ± 0.06***	-0.11 ± 0.02***	0.05 ± 0.02**	-0.006 ± 0.008
Sex (Girl): Age	0.26 ± 0.09**	0.14 ± 0.04***	--	0.03 ± 0.01*

Note: FRESC survey dataset. Total score in the SDQ is a discrete quantitative variable ranging from 0 to 40 with higher values pointing to higher probabilities of suffering a mental health issue. This index is based on 5 subscales or components (emotional, prosocial, behavioural, hyperactivity-attention deficits and problems with peers) with 5 questions in each component that can be answered following a three-level Likert format (Goodman, 1997). The emotional, the prosocial, and the behavioural components showed statistically significant relationships with sex, age, and the economic status of adolescents according to general and generalized linear models. Intercept corresponds to the average of the reference group, which is boys of the youngest age group and lowest economic status. Effect estimates along with their standard errors are shown for each factor with ***, **, and * denoting statistically significant differences with the

reference group with associated *P-values* of < 0.001 , < 0.01 , and < 0.05 , respectively. See Data Analysis section for further information on the modelling selection approach.

Table 3. Best models for the emotional and prosocial component of the SDQ for the studied adolescent population according to their gender adherence index (GAI), sex, age, and economic status.

	SDQ emotion 1	SDQ prosocial 2
Intercept	2.00 ± 0.47***	5.97 ± 0.31***
GAI	-0.06 ± 0.03*	0.11 ± 0.02***
Sex (Girl)	1.77 ± 0.08***	0.58 ± 0.06***
Age	0.08 ± 0.03**	0.03 ± 0.02
Economic status	-0.10 ± 0.03***	--

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772 Figure Captions

773 Figure 1. Relationships between sex of the adolescents and their health self-perception (A),
774 mental well-being (B) and level of despair (C). *** denotes strong statistically significant (*P-value*
775 < 0.001) differences between self-identified boy and girl survey respondents (n = 3888) according
776 to general linear models. See Table 1 for whole model outputs and data analyses section for
777 further methodological details. Note that higher values of health self-perception actually denote
778 lower health.

779 Figure 2. Interaction between sex and age over the total score on the Strengths and Difficulties
780 Questionnaire (SDQ, panel A), and its emotional (B), prosocial (C) and behavioural (D) subscales.
781 Statistically significant interactions according to general linear models are denoted by *, ** and
782 *** which refer to *P-values* < 0.05, < 0.01 and < 0.001, respectively. See Table 2 for whole model
783 outputs and data analyses section for further methodological details.

784 Figure 3. (A) Principal component analysis of the subscales of the Strengths and Difficulties
785 Questionnaire (SDQ). Each point represents one of the 3888 adolescents with complete answers
786 in the survey and sex (boy vs girl) are overlaid for visualization purposes. (B) Relationship between
787 sex condition and the scores of the second principal component axis (PC2) according to a general
788 linear model, with *** denoting a strongly significant statistical difference (*P-value* < 0.001)
789 between boys and girls.

790 Figure 4. (A) Principal component analysis of all the life habits variables selected to compute a
791 Gender Adherence Index (GAI). (B) The interaction between sex and age over the scores of the
792 first principal component axis (PC1), identified as the best GAI available, denotes a reduction of
793 the differences between boys and girls in their gender expression as they grow up. Statistically
794 significant differences calculated according to a general linear model with ** denoting a *P-value*
795 < 0.01.

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Figure 1

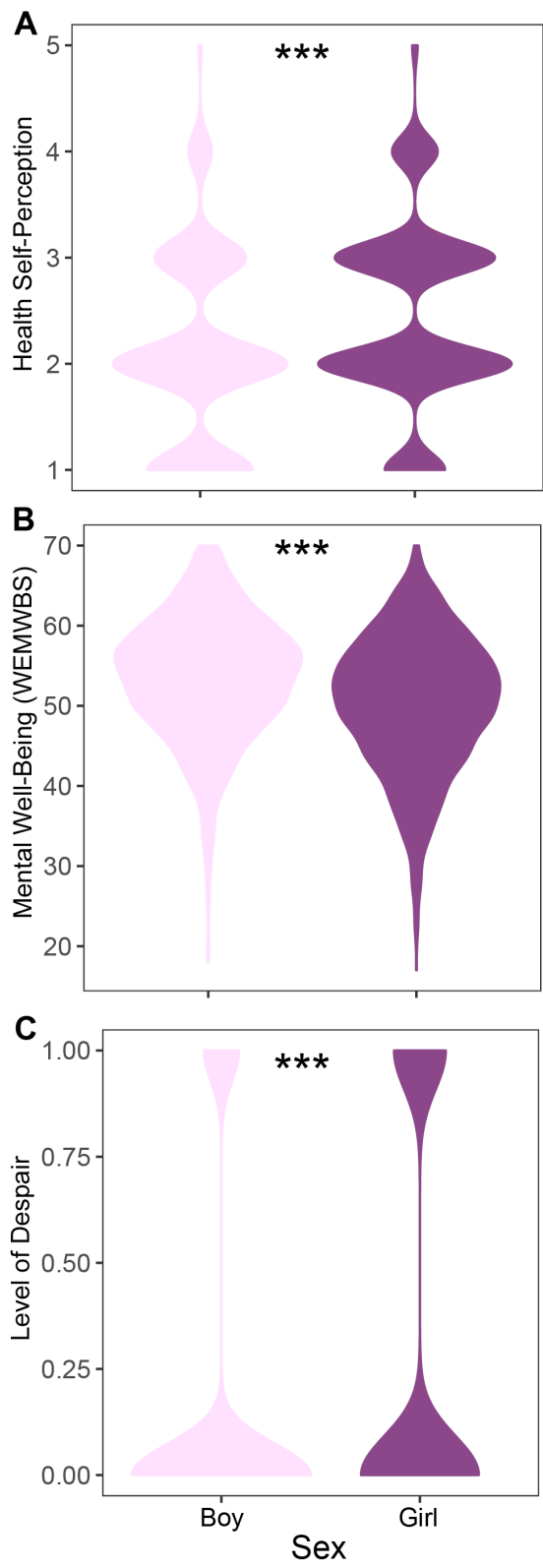
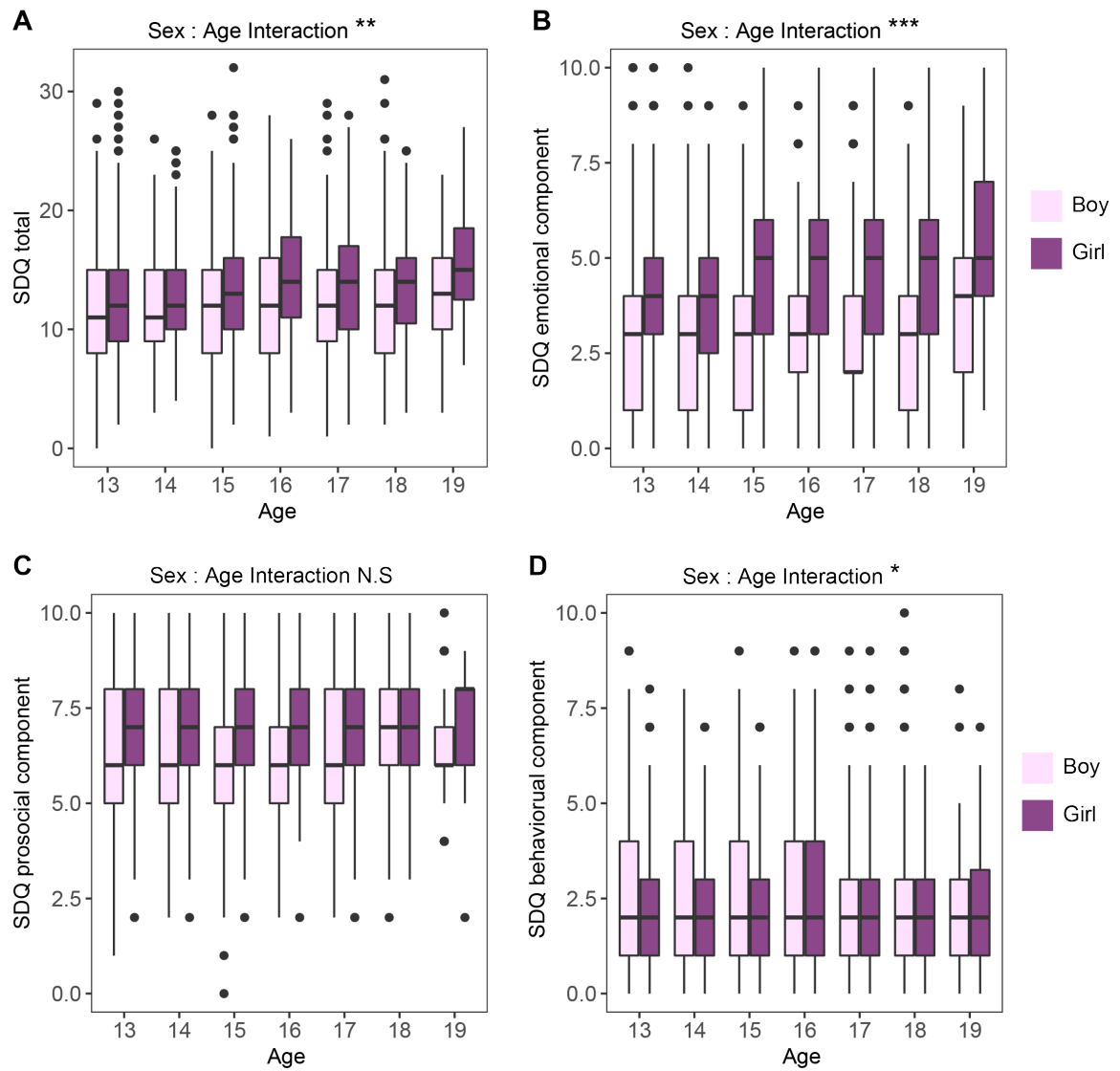
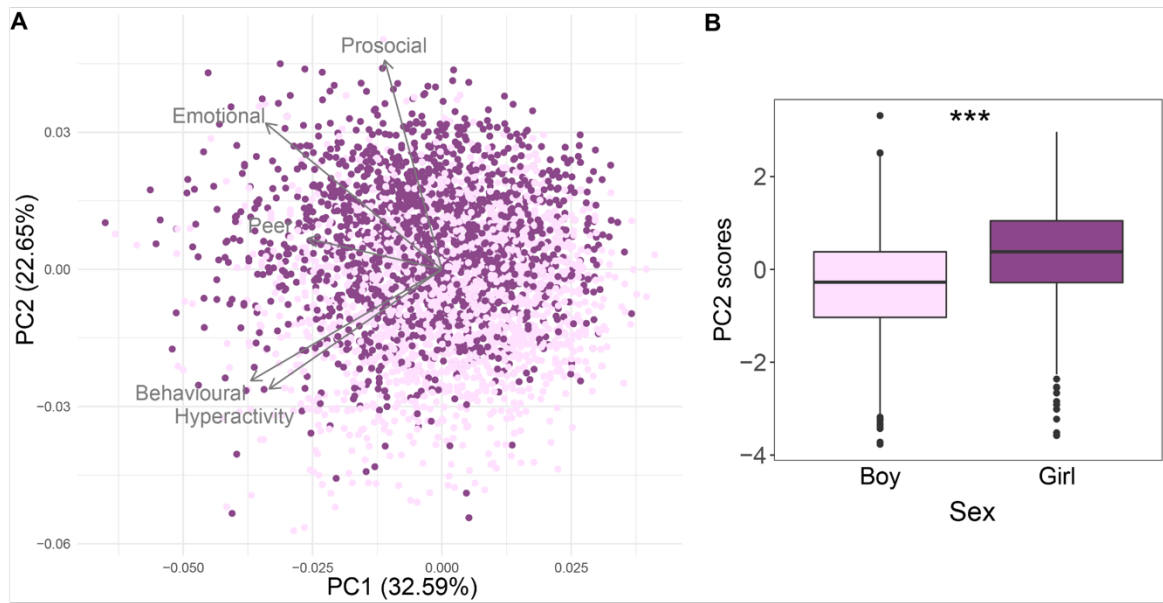


Figure 2



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Figure 3



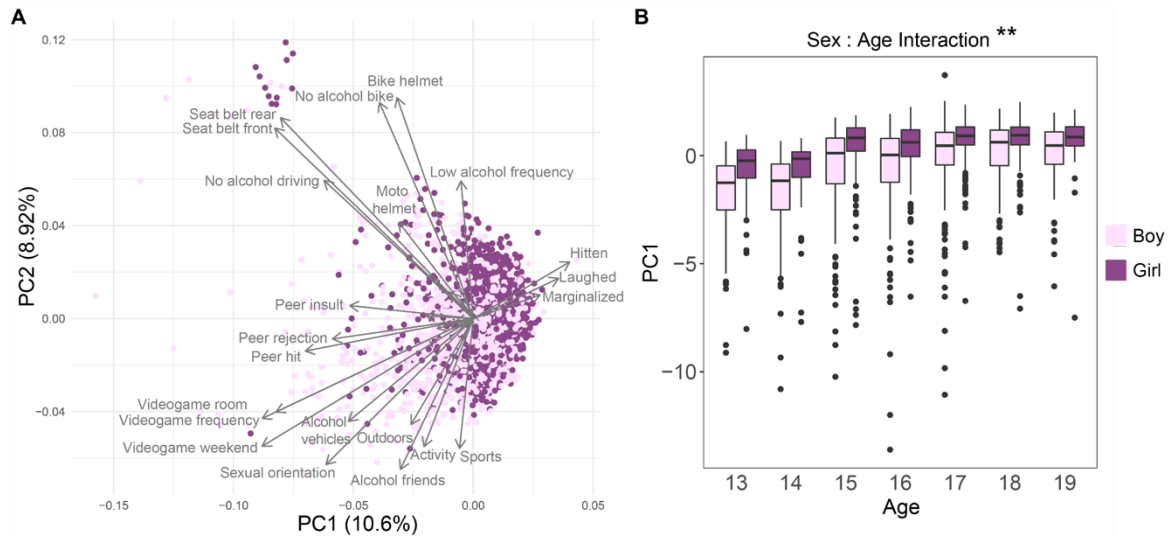
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Figure 4



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