



Gender and socioeconomic inequalities in adolescent mental well-being in Barcelona: a repeated cross-sectional study

Marc Olivella-Cirici^{1,2,3,4} · Gemma Vilagut^{2,4} · Esther Sánchez-Ledesma^{1,4,5} · Gemma Serral^{1,4,5} · Mònica Cortés-Albaladejo^{1,5} · Pol Montemayor Cejas^{6,7} · Maribel Pasarín^{1,3,4,5} · Jordi Alonso^{2,3,4} · Glòria Pérez^{1,3,4,5}

Received: 11 April 2025 / Accepted: 17 July 2025
© The Author(s) 2025, corrected publication 2025

Abstract

Aim This study analysed gender and socioeconomic (SE) inequalities in adolescent mental well-being in Barcelona, Spain, using data from two cross-sectional waves (2016 and 2021), examining the potential impact of the COVID-19 pandemic and considering pre-existing disparities. The research aimed to understand how these factors influenced mental well-being at two time points, with a particular focus on intersecting vulnerabilities.

Subject and methods A repeated cross-sectional analysis was performed using data from the FRESC survey (students aged 13–16 years: 2016, $N = 2274$; 2021, $N = 2179$). Mental well-being was measured using the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS). Multivariate linear regressions accounted for individual- and school-level SE characteristics, including clustering at the school level, and effect sizes (Cohen's d) were used to assess changes over time. Analyses included stratification by sex and exploration of collinearity among SE indicators.

Results Mental well-being scores were significantly lower in 2021 compared to 2016, with sharper reductions observed in girls (effect size = -0.43 , 95% CI -0.52 to -0.35) than in boys (-0.28 , 95% CI -0.36 to -0.19). Students from low SE backgrounds and state schools experienced the steepest declines, particularly girls (adjusted $\beta = -4.71$, $p < 0.001$). By contrast, immigrant students showed smaller differences between years, although they reported lower levels of well-being in both waves.

Conclusion The study revealed persistent gender and SE inequalities in adolescent mental well-being, with notable declines in 2021 coinciding with the aftermath of the COVID-19 pandemic. These findings emphasise the need for intersectional, gender- and equity-sensitive strategies, particularly those addressing youth facing multiple and intersecting social disadvantages.

Keywords Adolescent health · Mental well-being · Inequalities · COVID-19 · Gender · Socioeconomic status

✉ Marc Olivella-Cirici
molivell@aspb.cat

¹ Agència de Salut Pública de Barcelona (ASPB), Barcelona, Spain

² Health Services Research Group, Hospital del Mar Research Institute – IMIM, Barcelona, Spain

³ Medicine and Life Sciences Department (MELIS), Universitat Pompeu Fabra (UPF), Barcelona, Spain

⁴ Centro de Investigación Biomédica en Red Epidemiología y Salud Pública (CIBERESP), Madrid, Spain

⁵ Institut de Recerca Sant Pau (IR Sant Pau), Barcelona, Spain

⁶ Unitat de Sistemes d'Informació i Disseny de Processos, Consorci d'Educació de Barcelona (CEB), Barcelona, Spain

⁷ Department of Applied Economics, Universitat Autònoma de Barcelona (UAB), Cerdanyola del Vallès, Spain

Introduction

Mental well-being in adolescence is crucial for individual development and public health. It represents a positive state essential for overall health, denoting mental health as the capacity to cope with life's challenges and contribute to society (World Health Organization 2001). Social and economic sciences emphasise happiness and life satisfaction (Slade et al. 2017; Clark et al. 2019), while psychology focuses on personal growth and positive relationships (Bhugra et al. 2018). These perspectives highlight the need for comprehensive approaches to adolescent mental well-being.

Social inequities shape adolescent mental well-being, reflecting broader societal inequalities (Marmot 2005; Compton and Shim 2015). This study builds on the WHO framework on social determinants of health (Solar and Irwin

2010) and its adaptation to mental health during COVID-19 (Lotzin et al. 2020), and draws on intersectionality theory (Crenshaw 1994; Bowleg 2012). Intersectionality recognizes how gender, migration, and socioeconomic (SE) status interact, especially during crises such as the COVID-19 pandemic (Bowleg 2020).

The pandemic exacerbated pre-existing trends of deteriorating adolescent mental well-being (Cosma et al. 2020; Bitsko et al. 2022), driven by social inequities, economic instability, and technological disruption (O'Reilly 2020; Orben et al. 2020). Evidence shows unequal impact, with girls, younger adolescents, and those in low SE status experiencing greater harm (Gibson et al. 2021; Hartas 2021; Schoon and Henseke 2022; Jeriček Klanšček and Furman 2023; Hoyt et al. 2023). Gender intersects with SE status and migration background, compounding vulnerabilities (Kern et al. 2020).

Although several studies have documented deteriorations in adolescent mental well-being during the COVID-19 pandemic, few have used population-based data to assess temporal changes before and after the pandemic in Southern European urban settings. Moreover, most available studies are based on a single cross-sectional wave and do not allow for assessing social inequalities changes over time, particularly with stratification by sex and consideration of school-level indicators.

This study contributes to the existing literature by analysing two comparable, representative samples collected in 2016 and 2021 in Barcelona, applying an intersectional and equity-focused approach. By including school socioeconomic vulnerability and neighbourhood income as contextual variables, it provides new insights into how structural inequalities shape adolescent well-being across a syndemic context.

The aim of this study was to investigate the 2016–2021 changes of gender and socioeconomic inequalities in the mental well-being of adolescents in Barcelona, stratifying according to sex.

Methods

This study employed a repeated cross-sectional analysis (Pan 2021) based on data from two waves of the population-based survey “Lifestyle Risk Factors in Secondary School Students” (*Factors de Risc en Estudiants de Secundària, FRESC*, 2016 and 2021 editions), conducted by the Barcelona Public Health Agency and integrated in the Statistical Plan of Catalonia. The survey included two representative samples of 13 to 19-year-old high school students in Barcelona (Sánchez-Ledesma et al. 2021). A stratified random sampling was used, with the classroom as the sample unit, selected on the basis of the socioeconomic level of the

neighbourhood where the school was located, its ownership, and the district. An anonymous self-administered questionnaire collected data on various aspects of adolescent health, well-being, and its social determinants (Sánchez-Ledesma et al. 2021). The 2021 edition coincided with the third and fourth COVID-19 waves in Barcelona (Worldometer 2023). Data and results of the survey are publicly available (Barcelona Public Health Agency FRESC Survey Data Viewer: <https://www.aspb.cat/docs/fresc/>).

According to the International Standard Classification of Education 2011 (ISCED), in this study we included students from ISCED 2 (13–16 years old) from the academic years 2015–16 ($N = 2274$) and 2020–21 ($N = 2179$). In Spain, ISCED 2 is compulsory and universally covered, ensuring that all adolescents within this age group have access to education during these academic years, regardless of their socioeconomic background.

Study variables

The outcome variable of our study was mental well-being and it was assessed with the validated Warwick-Edinburgh Mental Well-Being Scale (WEMWBS), scored from 14 (poorest mental well-being) to 70 (best) (Tennant et al. 2007). This scale has been adapted and validated for use among Spanish students (López et al. 2013; Castellví et al. 2014). We excluded students lacking data on the WEMWBS (2016 $N = 55$, 2.4%; 2021 $N = 3$, 0.1%).

As covariates of the study we measured both individual- and school-level characteristics.

Individual co-variables included:

- *Academic grade*, categorised into “2nd ESO”, which is the 2nd year of Compulsory Secondary Education in Spain (13–14 years old); and “4th ESO”, for the 4th year (15–16 years old). Both grades are in ISCED 2.
- *Migratory background*, categorized into “native”, “native with immigrant parent(s)”, when the student was born in Spain and the father and/or mother were born abroad, and “immigrant”.
- *Socioeconomic (SE) status* (low/average/high) of each adolescent, measured using the validated Family Affluence Scale (FAS) (Currie et al. 2008). The 2016 survey used the FAS II version (Boudreau and Poulin 2009), while the 2021 survey used the FAS III (Hartley et al. 2016). The FAS III expands upon the FAS II by increasing the number of items from four to six, adding questions about the number of bathrooms and including tablets in the item about family computers, enhancing sensitivity and cultural relevance for a more accurate assessment of family SE status. The impact of this modification is discussed in more detail in the discussion.

School co-variables included:

- *School SE vulnerability*, categorized into quartiles by survey wave based on the ratio of students in a vulnerable situation. Thus, Q4 included students from schools with the highest percentage of students with SE vulnerability. SE vulnerability included indicators such as social services records indicating vulnerability and objective low SE status of the family, including receipt of minimum income, child benefits, or free school meals (Barcelona City Council 2023). We extracted these data from the Register of Vulnerable Students, curated by the Barcelona Education Consortium. Notably, it has been described how vulnerability correlates with migratory origin and school segregation (Bonal 2012; Bonal et al. 2019).
- *School neighbourhood SE status*, categorised in quartiles by survey wave, with Q4 representing schools in the most disadvantaged neighbourhoods. We used the Gross Disposable Household Income (GDHI) index of the school neighbourhood, which is a synthetic index presented in the form of a ratio between the income of the area and the average value for Barcelona as a whole (100). The higher the value of the index, the greater the economic capacity. We used the 2016 GDHI for the 2016 survey (Barcelona City Council 2018) and 2019 GDHI for the 2021 survey (Barcelona City Council 2022) as this was the latest update available. The 2016 index was based on an indirect calculation method using five consumption indicators and the 2019 one on a direct method based on tax data at census section level. The new methodology makes it possible to have a more direct empirical basis and with standardised procedures. We extracted this information from the Health and Policy Impact Observatory of the Barcelona City Council.
- *Type of school ownership*, categorised into “public” or “private”, with most private schools receiving public funding and having heterogeneous enrolment fees.

Data Analysis

To stratify the analyses, we used the sex variable (girls/boys), serving as a proxy for gender as health inequalities are due to gendered experiences and their social and environmental interactions (Rioux et al. 2022). Throughout the manuscript, we use “sex” to refer to the biological categorisation recorded in the survey and “gender” when discussing the social roles and norms that shape health inequalities.

Sample characteristics stratified by sex were reported as percentages for categorical variables and mean and standard deviation (SD) for continuous variables. Descriptive statistics of mental well-being across categories of all study variables in each moment of time, stratified by sex,

were reported as mean, SD, and 95% confidence interval of the mean. Statistical significance of the temporal differences on mental well-being were assessed with student's *t*-test for independent samples, and differences on mental well-being between co-variate categories using student's *t* or ANOVA, depending on the number of categories. Statistical significance was set at *p* value (*p*) < 0.05. For each group, the effect size of the difference in mental well-being means across time, and effect size of the difference by sex within each year of assessment were measured with Cohen's *d* (Coe 2002; Streiner and Norman 2012). Cut-offs for interpretation of the magnitude of the effect sizes were: 0.2 (small), 0.5 (medium/moderate), 0.8 (large), and 1.2 (very large) (Cohen 2013).

Bivariate and multivariate associations of the co-variables of interest and mental well-being were estimated using linear regression. Crude and adjusted β coefficients ($a\beta$) were calculated with their 95% confidence intervals (95% CI).

Explanatory variables for multivariate models were selected on the basis of their theoretical relevance to the social determinants of adolescent mental well-being, supported by prior literature. Multiple models were tested to evaluate consistency, collinearity, and parsimony, and the final specification was chosen for its conceptual coherence and explanatory power. To assess multicollinearity, we calculated variance inflation factors (VIFs), all of which were below 5, indicating no evidence of harmful collinearity. Residual checks were conducted to confirm normality, homoscedasticity, and linearity assumptions, with no major violations observed. Interaction terms between key variables (e.g. survey year and school socioeconomic status) were explored but excluded due to lack of statistical significance. We also tested interaction terms between sex, social determinants, and survey year to assess potential intersectional effects. Analyses were conducted using Stata version 17 (StataCorp 2023).

Results

Table 1 shows the distribution of key study variables across sex and survey year. The average age of the overall sample was 14.3 years (SD 1.1). In both years, a little more than half of the students were in 2nd ESO (51.7 and 51.3% in 2016 and 2021, respectively). There was a decrease of natives (from 68.1% to 63.4%) and immigrants (from 15.7% to 11.5%) in favour of natives with an immigrant mum and/or dad (from 15.1% to 20.7%) and missing data (from 1.0% to 4.4%). There were notable changes in SE status: in 2016, 45.5% of students were at the high SE status level, which decreased to 25.8% by 2021, while the low SE status level increased from 13.0% to 17.9%. The average vulnerability index was 0.11 (SD 0.11) in 2016 and 0.12 in 2021 (SD

Table 1 Description of the samples. Girls and boys schooled in compulsory secondary education in Barcelona. FRESA waves 2016 and 2021

2016 sample variables		% (n) Total (n = 2274)	% (n) Girls (n = 1092)	% (n) Boys (n = 1182)	p-value ^a
Age (mean [SD]) ^b		14.4 [1.2]	14.3 [1.2]	14.4 [1.2]	0.014
Academic grade					
	2 nd ESO	51.7 (1176)	52.1 (569)	51.4 (607)	0.720
	4 th ESO	48.3 (1098)	47.9 (523)	48.7 (575)	
Migratory background					
	Native	68.1 (1549)	66.2 (723)	69.9 (826)	0.291
	Native with immigrant parent(s)	15.1 (344)	15.8 (172)	14.6 (172)	
	Immigrant	15.7 (358)	16.9 (185)	14.6 (173)	
	Missings	1.0 (23)	1.1 (12)	0.93 (11)	
Socioeconomic status (FAS) of the student					
	High	45.5 (1034)	44.6 (487)	46.3 (547)	0.777
	Average	41.0 (932)	41.2 (450)	40.8 (482)	
	Low	13.0 (295)	13.6 (148)	12.4 (147)	
	Missings	0.6 (13)	0.6 (7)	0.5 (6)	
Socioeconomic vulnerability of the school (mean [SD]) ^{b,c}		0.11 [0.11]			
	Q1 (most privileged)	26.6 (604)	27.3 (298)	25.9 (306)	0.668
	Q2	23.9 (543)	23.4 (255)	24.4 (288)	
	Q3	26.0 (592)	26.7 (291)	25.5 (301)	
	Q4 (most disadvantaged)	23.5 (535)	22.7 (248)	24.3 (287)	
Neighbourhood socioeconomic status (GDHI) of the school (mean [SD]) ^{b,c}		110.8 [32.6]			
	Q1 (most privileged)	23.7 (538)	25.0 (273)	22.4 (265)	0.277
	Q2	24.8 (563)	23.3 (254)	26.1 (309)	
	Q3	21.6 (490)	22.1 (241)	21.1 (249)	
	Q4 (most disadvantaged)	30.0 (683)	29.7 (324)	30.4 (359)	
School ownership					
	Private	69.7 (1584)	67.7 (739)	71.5 (845)	0.048
	State	30.3 (690)	32.3 (353)	28.5 (337)	
Mental well-being (WEMWBS) (mean [SD]) ^d		52.5 [8.2]	50.8 [8.3]	54.0 [7.8]	<0.001
2021 sample		Total (n = 2179)	Girls (n = 1062)	Boys (n = 1117)	
Age (mean [SD]) ^b		14.3 [1.1]	14.3 [1.1]	14.4 [1.1]	0.443
Academic grade					
	2 nd ESO	51.3 (1117)	51.2 (544)	51.3 (573)	0.972
	4 th ESO	48.7 (1,062)	48.8 (518)	48.7 (544)	
Migratory background					
	Native	63.4 (1382)	64.3 (683)	62.6 (699)	0.393
	Native with immigrant parent(s)	20.7 (451)	20.3 (216)	21.0 (235)	
	Immigrant	11.5 (250)	11.7 (124)	11.3 (126)	
	Missings	4.4 (96)	3.7 (39)	5.1 (57)	
Student socioeconomic status (FAS)					
	High	25.8 (563)	25.6 (272)	26.1 (291)	0.250
	Average	56.3 (1227)	57.8 (614)	54.9 (613)	
	Low	17.9 (389)	16.6 (176)	19.1 (213)	
	Missings	0.0 (0)	0.0 (0)	0.0 (0)	
Socioeconomic vulnerability of the school (mean [SD]) ^{b,c}		0.12 [0.14]			
	Q1 (most privileged)	27.2 (593)	28.4 (302)	26.1 (291)	0.017
	Q2	23.8 (518)	25.8 (274)	21.8 (244)	
	Q3	24.5 (534)	23.6 (251)	25.3 (283)	
	Q4 (most disadvantaged)	24.5 (534)	22.1 (235)	26.8 (299)	
School neighbourhood socioeconomic status (GDHI) (mean [SD]) ^{b,c}		108.6 [36.4]			

Table 1 (continued)

2016 sample variables		% (n) Total (n = 2274)	% (n) Girls (n = 1092)	% (n) Boys (n = 1182)	p-value ^a
	Q1 (most privileged)	22.6 (493)	23.9 (254)	21.4 (239)	0.096
	Q2	26.7 (582)	26.7 (282)	24.9 (300)	
	Q3	25.6 (558)	26.7 (283)	24.6 (275)	
	Q4 (most disadvantaged)	25.1 (546)	22.9 (243)	27.1 (303)	
Type of school ownership					
	Private	71.6 (1561)	73.0 (775)	70.4 (786)	0.177
	State	28.4 (618)	27.0 (287)	29.6 (331)	
Mental well-being (WEMWBS) (mean [SD]) ^d		49.4 [9.3]	47.0 [9.2]	51.7 [8.8]	<0.001

FRESC Factors de Risc a l'Escola Secundària survey; *SD* Standard deviation; *FAS* Family Affluence Scale; *GDHI* Gross disposable household income; *WEMWBS* Warwick-Edinburgh Mental Well-Being Scale

^a *p* value calculated by chi square test

^b *p* value calculated by Mann–Whitney test

^c mean calculated over schools

^d *p* value calculated by *t*-test

0.14), with 23.5% of students in the highest vulnerability group (Q4) in 2016 and 24.5% in 2021, showing significant differences by sex (girls 22.1%; boys 26.8%; $p = 0.017$). School neighbourhood SE status (GDHI mean) was 110.8 (SD 32.6) in 2016 and 108.6 (SD 36.4) in 2021. Approximately 70% of adolescents attended privately owned school in both survey years. Mental well-being (WEMWBS mean) decreased from 52.5 (SD 8.2) in 2016 to 49.4 (SD 9.3) in 2021 with significant differences by sex in 2016 (girls 50.8 [SD 8.3]; boys 54.0 [SD 7.8], $p < 0.001$) and 2021 (girls 47.0 [SD 9.2]; boys 51.7 [SD 8.8], $p < 0.001$).

Table 2 shows the levels of mental well-being and its effect size according to the different study groups and years. We observed worse levels of mental well-being in 2021 compared to 2016, in all categories studied, with an overall temporal effect size of -0.43 (95% CI -0.52 ; -0.35) in girls and -0.28 (95% CI -0.19 ; -0.36) in boys. Boys showed higher levels of mental well-being, with a medium/moderate effect size in sex differences of -0.40 in 2016 (95% CI -0.31 ; -0.48) and -0.52 in 2021 (95% CI -0.44 ; -0.61). Regarding the academic grade, only in 2016, we observed significantly lower levels of mental well-being in 4th ESO compared to 2nd ESO, both in girls (50.1 vs 51.4; $p = 0.010$) and in boys (53.5 vs 54.6; $p = 0.022$). Immigrants presented worse levels of mental well-being in both years ($p < 0.001$), in both sexes, especially in girls in 2021 (46.0, 95% CI 44.4–47.7). Except for girls in 2016, in the bivariate analysis, we observed that students with worse mental well-being attended more state schools than private ones (boys in 2021: 50.6 vs 52.2; $p = 0.008$) with a moderate effect size in sex differences (0.53; 95% CI 0.44–0.61). In both 2016 and 2021, a social gradient in mental well-being emerged by looking at the variables of

student SE status, school neighbourhood GDHI, and school vulnerability index. Girls in low SE status, attending schools with high SE vulnerability (Q4) and located in disadvantaged neighbourhoods (Q4 of GDHI) experienced the worst levels of mental well-being in 2021, showing significant differences compared to more privileged school contexts (SE vulnerability of the school 46.2 [SD 8.9] vs 49.2 [SD 9.0]; $p < 0.001$) and a medium/moderate effect size when compared to boys (0.44, 95% CI 0.36–0.53).

Table 3 shows adjusted changes in mental well-being according to the different groups in each studied year. In multiple regression models, girls in 4th ESO ($\alpha\beta = -1.23$; $p = 0.013$) and immigrants ($\alpha\beta = -3.62$; $p < 0.001$) showed the greatest mental well-being decrease in 2016. We observed a loss of these significant changes in 2021 for both sexes in the adjusted models. We also did not observe significant differences in school ownership in the adjusted models (e.g. girls in 2021; state vs private schools: $\alpha\beta = 1.27$; $p = 0.07$), but in some groups in the bivariate analysis (see Supplementary Table). Except for girls in 2016, the rest of the low SE status groups presented a significant worsening of mental well-being compared to the high SE status, notably in boys in 2016 ($\alpha\beta = -3.44$; $p < 0.001$). We observed significant differences for girls attending schools with high SE vulnerability (for Q2 and Q3, not Q4) in 2021 (e.g. Q3 $\alpha\beta = -2.5$, $p = 0.007$) and boys in 2016 (Q2 and Q4) (e.g. Q4 $\alpha\beta = -1.82$, $p = 0.01$).

Table 4 presents the adjusted temporal changes in socioeconomic inequalities in mental well-being. Across all groups, we observed the greatest temporal deterioration of mental well-being in girls. There was a significant difference in mental well-being scores between 2016 and

Table 2 Levels of mental well-being (WEMWBS means) among girls and boys schooled in compulsory secondary education in Barcelona. FRESA waves 2016 and 2021

Variables	Girls			Boys							Girls vs boys															
	2016 (n = 1092)			2021 (n = 1062)			2016 vs 2021			2016 (n = 1182)			2021 (n = 1117)			2016 vs 2021			2016			2021				
	Mean (SD)	95% CI		Mean (SD)	95% CI		p-value ^a	Effect size ^c	95% CI	Mean (SD)	95% CI		Mean (SD)	95% CI		p-value ^a	Effect size ^c	95% CI	Effect size ^c	95% CI	Effect size ^c	95% CI				
Total	50.8 (8.3)	50.3	51.3	47.0 (9.2)	46.5	47.6	<0.001	-0.43	-0.52	-0.35	54.0 (7.8)	53.6	54.5	51.7 (8.8)	51.2	52.2	<0.001	-0.28	-0.36	-0.19	-0.40	-0.48	-0.31	-0.52	-0.61	-0.44
Academic grade																										
2 nd ESO	51.4 (8.3)	50.7	52.1	47.2 (9.4)	46.4	48.0	<0.001	-0.47	-0.56	-0.39	54.6 (7.3)	54.0	55.1	51.7 (8.9)	51.0	52.4	<0.001	-0.36	-0.44	-0.27	-0.41	-0.49	-0.33	-0.49	-0.58	-0.41
4 th ESO	50.1 (8.3)	49.4	50.8	46.8 (8.9)	46.0	47.6	<0.001	-0.38	-0.47	-0.30	53.5 (8.2)	52.8	54.2	51.7 (8.6)	51.0	52.4	<0.001	-0.21	-0.30	-0.13	-0.41	-0.50	-0.33	-0.56	-0.65	-0.47
p value ^a	0.01			0.488							0.022			0.987												
Migratory background																										
Native	51.8 (7.8)	51.2	52.3	47.8 (9.1)	47.1	48.4	<0.001	-0.47	-0.56	-0.39	54.5 (7.4)	54.0	55.0	52.5 (8.3)	51.8	53.1	<0.001	-0.25	-0.34	-0.17	-0.36	-0.44	-0.27	-0.54	-0.63	-0.45
Native with immi-grant mum/dad	50.2 (8.3)	48.9	51.4	45.9 (8.9)	44.7	47.0	<0.001	-0.50	-0.59	-0.41	53.7 (7.8)	52.5	54.8	50.4 (9.2)	50.9	52.6	<0.001	-0.39	-0.47	-0.31	-0.44	-0.52	-0.35	-0.50	-0.58	-0.41
Immi-grant mum/dad	47.8 (9.6)	46.4	49.2	46.0 (9.4)	44.4	47.7	0.054	-0.19	-0.27	-0.10	51.9 (9.0)	50.6	53.3	50.3 (9.6)	48.6	52.0	0.064	-0.17	-0.25	-0.09	-0.44	-0.52	-0.36	-0.45	-0.54	-0.37
p value ^b	<0.001			0.001							<0.001			0.002												
Socioeconomic status (FAS) of the student																										
High	52.1 (8.0)	51.4	52.8	48.4 (9.4)	47.3	49.5	<0.001	-0.42	-0.51	-0.34	55.6 (7.5)	55.0	56.3	53.2 (8.4)	52.2	54.2	<0.001	-0.30	-0.38	-0.22	-0.45	-0.54	-0.37	-0.54	-0.62	-0.45
Average	50.1 (8.3)	49.3	50.8	46.9 (8.8)	46.2	47.6	<0.001	-0.37	-0.46	-0.29	53.1 (7.3)	52.5	53.8	51.4 (8.8)	50.7	52.1	0.001	-0.21	-0.29	-0.13	-0.38	-0.47	-0.30	-0.51	-0.60	-0.43
Low	48.8 (8.8)	47.4	50.2	45.4 (9.8)	43.9	46.8	0.001	-0.37	-0.45	-0.28	51.2 (8.8)	49.8	52.7	50.5 (8.9)	49.3	51.7	0.416	-0.08	-0.16	0.00	-0.27	-0.36	-0.19	-0.55	-0.63	-0.46
p value ^b	<0.001			0.003							<0.001			0.001												
Socioeconomic vulnerability of the school																										
Q1 (most privileged)	52.2 (7.5)	51.3	53.0	49.2 (9.0)	48.2	50.2	<0.001	-0.36	-0.45	-0.28	55.7 (7.1)	54.9	56.5	53.0 (7.9)	52.1	53.9	<0.001	-0.36	-0.44	-0.28	-0.48	-0.56	-0.40	-0.45	-0.53	-0.36
Q2	50.7 (8.5)	49.6	51.7	46.4 (9.4)	45.3	47.5	<0.001	-0.48	-0.57	-0.39	53.7 (8.1)	52.8	54.6	52.0 (8.7)	50.9	53.1	0.018	-0.20	-0.28	-0.12	-0.36	-0.44	-0.28	-0.62	-0.70	-0.53
Q3	50.4 (8.7)	49.4	51.4	45.8 (9.1)	44.7	46.9	<0.001	-0.52	-0.60	-0.43	54.4 (7.2)	53.5	55.2	51.6 (8.6)	50.6	52.6	<0.001	-0.35	-0.44	-0.27	-0.50	-0.59	-0.42	-0.66	-0.74	-0.57

Table 2 (continued)

Variables	Girls				Boys				Girls vs boys			
	2016 (n = 1092)		2021 (n = 1062)		2016 (n = 1182)		2021 (n = 1117)		2016 vs 2021		2016	
	Mean (SD)	95% CI	Mean (SD)	95% CI	Mean (SD)	95% CI	Mean (SD)	95% CI	p-value ^a	Effect size ^c	Effect size ^c	95% CI
Q4 (most disadvantaged) (8.4)	49.7	48.7	50.7	46.2 (8.9)	47.4	45.1	47.4	45.1	<0.001	-0.40	-0.49	-0.32
Q1 (most privileged) (8.0)	47.7	49.8	48.8	47.7	49.8	48.1	49.8	48.1	<0.001	-0.44	-0.53	-0.36
Q2 (8.3)	51.0	50.0	52.1	47.0 (9.7)	45.9	48.1	45.9	48.1	<0.001	-0.44	-0.53	-0.36
Q3 (8.4)	51.3	50.3	52.4	46.0 (9.0)	45.0	47.1	45.0	47.1	<0.001	-0.61	-0.70	-0.52
Q4 (most disadvantaged) (8.5)	49.8	48.9	50.8	46.3 (9.3)	45.1	47.5	45.1	47.5	<0.001	-0.39	-0.48	-0.31
p value ^b	0.095		0.003		0.103		0.005					
School ownership												
Private (8.2)	51.0	50.4	51.6	47.5 (9.1)	46.9	48.1	46.9	48.1	<0.001	-0.40	-0.49	-0.32
State (8.6)	50.4	49.5	51.3	45.7 (9.4)	44.6	46.8	44.6	46.8	<0.001	-0.52	-0.61	-0.44
p value ^a	0.257		0.005		0.007		0.008					

FRESC Factors de Risc a l'Escola Secundària survey; SD Standard Deviation; 95% CI 95% confidence interval; WEMWBS Warwick-Edinburgh Mental Well-Being Scale; FAS Family Affluence Scale; GDHI Gross disposable household income

^a p value calculated by student's t test

^b p value calculated by ANOVA test

^c effect size calculated by Cohen's d

Table 3 Multivariate analysis of changes in mental well-being according to demographic and socioeconomic variables in girls and boys schooled in compulsory secondary education in Barcelona. FRESC waves 2016 and 2021

Variables	Girls				Boys			
	2016		2021		2016		2021	
	a β	95% CI	p-value	a β	95% CI	p-value	a β	95% CI
Academic grade								
2 nd ESO	ref			ref			ref	
4 th ESO	-1.23	-2.21 -0.26	0.013	-0.33	-1.45 0.8	0.566	-0.91	-1.78 -0.03
Migratory background								
Native	ref			ref			ref	
Native with immigrant mum/ dad	-1.37	-2.77 0.03	0.055	-1.4	-2.86 0.05	0.058	-0.26	-1.53 1.01
Immigrant	-3.62	-5.1 -2.14	<0.001	-1.07	-2.91 0.77	0.253	-0.97	-2.35 0.4
Socioeconomic status (FAS) of the student								
High	ref			ref			ref	
Average	-1.63	-2.7 -0.55	0.003	-1.09	-2.41 0.23	0.105	-2.22	-3.17 -1.26
Low	-1.54	-3.24 0.16	0.076	-1.86	-3.7 -0.02	0.047	-3.44	-4.97 -1.92
Socioeconomic vulnerability of the school								
Q1 (most privileged)	ref			ref			ref	
Q2	-1.17	-2.55 0.22	0.099	-2.54	-4.05 -1.03	0.001	-1.67	-2.9 -0.44
Q3	-1.65	-3.31 0.01	0.051	-2.5	-4.31 -0.69	0.007	-0.43	-1.83 0.97
Q4 (most disadvantaged)	-1.1	-2.71 0.51	0.18	-1.24	-3.26 0.77	0.226	-1.82	-3.24 -0.4
School ownership								
Private	ref			ref			ref	
State	1.27	-0.11 2.65	0.07	-0.78	-2.45 0.89	0.359	-0.4	-1.59 0.8

FRESC Factors de Risc a l'Escola Secundària survey; *a β* β coefficient adjusted for academic grade, migratory background, type of school ownership, and socioeconomic vulnerability of the school; 95% CI 95% confidence interval; FAS Family Affluence Scale

Table 4 Multivariate analysis of changes 2016–2021 in socioeconomic inequalities in mental well-being among girls and boys schooled in compulsory secondary education in Barcelona. FRESC waves 2016 and 2021

Variables		Girls				Boys			
		aβ	95% CI		<i>p</i> value	aβ	95% CI		<i>p</i> value
Academic grade									
	2 nd ESO	−3.87	−4.93	−2.81	<0.001	−2.31	−3.28	−1.34	<0.001
	4 th ESO	−3.08	−4.16	−2.00	<0.001	−1.24	−2.23	−0.25	0.014
Migratory background									
	Native	−3.61	−4.52	−2.70	<0.001	−1.73	−2.53	−0.92	<0.001
	Native with immigrant mum/dad	−4.42	−6.18	−2.66	<0.001	−2.47	−4.23	−0.71	0.006
	Immigrant	−1.66	−3.87	0.56	0.142	−1.24	−3.35	0.87	0.25
Socioeconomic status (FAS) of the student									
	High	−3.68	−4.95	−2.40	<0.001	−2.29	−3.42	−1.16	<0.001
	Average	−3.24	−4.30	−2.19	<0.001	−1.70	−2.68	−0.72	0.001
	Low	−3.52	−5.67	−1.37	0.001	−1.00	−3.04	1.03	0.331
Socioeconomic vulnerability of the school									
	Q1 (most privileged)	−2.52	−3.92	−1.12	<0.001	−1.92	−3.16	−0.69	0.002
	Q2	−4.16	−5.76	−2.55	<0.001	−1.24	−2.79	0.31	0.116
	Q3	−4.30	−5.87	−2.74	<0.001	−2.37	−3.70	−1.03	0.001
	Q4 (most disadvantaged)	−3.60	−5.24	−1.96	<0.001	−1.44	−2.97	0.09	0.065
School ownership									
	Private	−3.00	−3.90	−2.10	<0.001	−1.75	−2.56	−0.94	<0.001
	State	−4.71	−6.19	−3.24	<0.001	−2.02	−3.40	−0.64	0.004

FRESC Factors de Risc a l'Escola Secundària survey; a β β coefficient adjusted for academic grade, migratory background, type of school ownership, and socioeconomic vulnerability of the school; 95% CI 95% confidence interval; FAS Family Affluence Scale

2021 in both academic grades, with younger girls experiencing the most pronounced decrease ($a\beta = -3.87$, $p < 0.001$). Native students and those with immigrant mum and/or dad of both sexes showed significant mental well-being worsening (e.g. native girls with immigrant mum/dad $a\beta = -4.42$, $p < 0.001$). Conversely, no significant changes were found in immigrant students (e.g. boys $a\beta = -1.24$, $p = 0.250$). Both girls and boys in private and state schools experienced mental well-being declines from 2016 to 2021, especially girls in state schools ($a\beta = -4.71$, $p < 0.001$). Among girls, mental well-being worsened similarly across all SE vulnerability categories in 2021 compared to 2016 (e.g. Q4 $a\beta = -3.60$, $p < 0.001$). For boys, mental well-being deterioration was significant in Q1 and Q3, but not in Q2 and Q4, the most disadvantaged group (Q4 $a\beta = -1.44$, $p = 0.065$), although a worsening trend is observed.

Additional analyses tested interactions between sex and key social determinants (individual socioeconomic status, school vulnerability, neighborhood socioeconomic status, and migration background), none of which were statistically significant (all $p > 0.39$). However, a significant interaction between sex and survey year ($F = 8.63$, $p = 0.004$) indicated that the decline in mental well-being between 2016 and 2021 was greater among girls.

Discussion

Our study shows significant changes in mental well-being among adolescents in Barcelona between 2016 and 2021, highlighting considerable gender and SE inequalities. The results reveal a general decline in mental well-being after the first epidemic waves of the COVID-19 pandemic across all groups, with pronounced inequalities based on sex, migratory background, and school socioeconomic characteristics. Underprivileged groups, especially girls, exhibited worse mental well-being levels in both years studied. While our analyses did not find significant interactions between sex and social determinants, indicating that these factors affect boys and girls similarly, overall gender inequalities in mental well-being persist, with girls consistently reporting lower levels and experiencing greater declines over time.

The observed deterioration in mental well-being in a post-pandemic context is consistent with literature describing potential psychological impacts of prolonged social isolation, disrupted routines, and heightened stress during the pandemic (De Figueiredo et al. 2021; Kerekes et al. 2021). Our findings indicate that the negative change in adolescent mental well-being predates the pandemic, reflecting broader societal issues such as economic instability and social inequities (Cosma et al. 2020; Orben et al. 2020).

Beyond the direct effects of the pandemic, educational measures implemented in Barcelona may have influenced adolescent mental well-being. Remote learning during the lockdown disproportionately affected students from disadvantaged backgrounds, who had more limited access to digital devices, private space, and adult support for learning—factors associated with increased stress and reduced emotional well-being (Bonal and González 2020). Although schools in Barcelona were reopened in September 2020, as early as possible following initial lockdown, with strong public health measures in place, the school reopening itself was a policy aimed at reducing educational and social inequalities. However, the initial phase of school closures and subsequent preventive measures, such as class quarantines and intermittent disruptions, may have contributed to the social gradient observed in mental well-being (González and Bonal 2021).

Our study found that girls reported lower levels of mental well-being compared to boys, with the gender gap widening over time. This is consistent with prior research indicating that adolescent girls are more vulnerable to internalizing behaviours and psychological distress (Campbell et al. 2021; Hartas 2021). The COVID-19 pandemic may have contributed to the widening of this gap due to increased caregiving responsibilities, heightened social media use, and significant disruptions to their social networks (Hoyt et al. 2023). Similar to other epidemics like Zika and Ebola, COVID-19 has intensified gender inequalities, often referred to as “the shadow pandemic”, highlighting the adverse impact of cultural forms of patriarchy on youth (Mitchell and Smith 2020).

Immigrant adolescents, particularly girls, consistently reported lower mental well-being compared to their native peers in both 2016 and 2021. This is consistent with research highlighting the unique challenges faced by immigrant youth, including acculturation stress, discrimination, and SE hardships (Kern et al. 2020). Notably, the worsening mental well-being from 2016 to 2021 was more pronounced among natives, contrary to previous research on the impact of the COVID-19 pandemic (Pieh et al. 2022; Thomeer et al. 2023). While migration status has been identified as a risk factor for mental health problems during the pandemic (Pieh et al. 2022), other studies suggest that ethnic minority students may exhibit greater resilience due to their exposure to adversity (Barbayannis et al. 2022).

Lower SE status and high SE vulnerability were strongly associated with poorer mental well-being in both 2016 and 2021. Adolescents from low SE status backgrounds, especially girls, exhibited significantly lower mental well-being scores, underscoring the impact of SE inequalities on mental health and reinforcing the role of the social context and local environment in shaping adolescent mental health. This aligns with studies showing how financial stress, lack of resources, and limited access to supportive environments contribute to adverse mental health outcomes (Marmot

2005; Compton and Shim 2015). These findings support the need for community and school-based interventions to enhance supportive environments and resources for adolescents (Bonal 2012; Bonal et al. 2019).

The mental well-being deterioration between 2016 and 2021 affected all groups of girls. Boys from low SE status background did not experience as pronounced deterioration in mental well-being, following a pattern similar to that observed for immigrants. Healthy behaviours are perceived as more normative for the upper-middle class, leading to increased intentions to engage in them (Blondé et al. 2022). Therefore, we hypothesize that the deprivation of healthy activities, such as physical exercise, during the COVID-19 pandemic may have caused more discomfort in more privileged boys. Additionally, disruptions in resources and support networks that historically benefited privileged groups might have exacerbated the decline in mental well-being, which could help explain the observed decline in mental well-being among girls, regardless of their SE vulnerability level. Other findings suggest that students with high stress levels and a history of adversity may experience a less pronounced impact on their mental health during challenging periods like the COVID-19 pandemic (Barbayannis et al. 2022). This aligns with a systematic review indicating that students with pre-existing mental health issues or trauma history may have developed coping mechanisms or resilience, mitigating the impact of new stressors encountered during academic life (Campbell et al. 2022).

From an intersectional perspective, our analysis revealed that mental well-being is influenced by the interplay of multiple social identities, including sex/gender, SE status, and migratory background. This highlights the compounded disadvantages faced by adolescent girls from low SE status and immigrant backgrounds, necessitating multifaceted intervention strategies (Crenshaw 1994; Bowleg 2020). Other studies have also identified significant inequities cutting across various intersecting social identities among youth (Hoyt et al. 2023; Moreno-Agostino et al. 2024).

Our study underscores the importance of addressing social determinants of health to mitigate the decline in adolescent mental well-being. Public policies are needed to change the disadvantaged situations of groups experiencing inequalities in health. Gender-sensitive and culturally tailored interventions are crucial to address the specific needs of vulnerable groups. Additionally, efforts to reduce SE inequities and enhance community support systems are vital for promoting equitable mental health outcomes.

Limitations and strengths

The findings are constrained by the construct of mental well-being itself, which does not necessarily reflect mental illness. This distinction is crucial as mental well-being, though indicative of broader psychological health, may not directly

capture clinical conditions such as depression or anxiety. Our study used sex, as recorded in the survey, as a proxy for gender. This limits the ability to fully capture the influence of socially constructed gender norms, roles, and identities on adolescent mental well-being. Although the 2021 edition of the FRESC survey included a self-identified gender variable, it was not present in 2016, which precluded its use for temporal comparisons. Future research should incorporate direct measures of gender identity and expression to better inform gender-sensitive and equity-focused public health strategies.

Additionally, the study was conducted in a single city, Barcelona, which limits the generalizability of the findings to other urban or rural settings. The data also only capture one time point after the COVID-19 pandemic onset, hindering our ability to assess long-term mental health trends beyond the immediate impact of the crisis. This may over-emphasise pandemic-related stressors and not account for other structural factors affecting mental health over longer periods.

The study's cross-sectional design, based on data from two waves of a survey, limits the ability to establish causal relationships and track mental well-being trends over time. While this restricts the depth of understanding on how mental well-being evolves within individuals and communities from different socio-demographic groups, the use of a population-based survey design still offers significant strengths. Specifically, it allows for the capture of a broad range of sociodemographic variables and self-reported measures of mental health across diverse populations. Additionally, the representativeness of the survey ensures that the findings can be generalized to the broader adolescent population in Barcelona (Sánchez-Ledesma et al. 2022), providing valuable insights for identifying changes and disparities in mental health that can inform public health planning and policy-making (Arias De La Torre et al. 2023). Future research employing longitudinal designs and incorporating qualitative data with a mixed methods approach could provide a deeper understanding of the complex interplay between socio-demographic factors and mental health outcomes among adolescents. The existing survey's strength lies in its ability to highlight critical inequalities and guide targeted public health strategies, laying the groundwork for more nuanced future studies.

Given the large number of statistical tests performed, the potential for type I error inflation should be acknowledged. However, no multiple comparison adjustment was applied, as the analyses were exploratory and aimed at identifying social patterns rather than making inferential claims.

There are limitations associated with the sequential use of different versions of the FAS and GDHI index over time. Specifically, the FAS used version II in 2016 and version III in 2021. This change was motivated by growing evidence that FAS II had lost discriminatory capacity in contexts with

higher levels of wealth or poverty, prompting the development of FAS III with two additional elements (e.g. the number of bathrooms at home and the inclusion of tablets in the question about family computers) to enhance sensitivity and accuracy in assessing family affluence. Psychometric validation studies have shown that FAS III retains cross-cultural and cross-time reliability in capturing a general affluence factor (the FAS Development Study Group et al. 2016; Currie et al. 2024; Brook et al. 2024). However, the shift between versions introduces a measurement inconsistency that must be acknowledged, as the socioeconomic classification of adolescents is not directly equivalent across waves. Similarly, for the GDHI index, the calculation method differed between the two years, but this resulted in minimal changes in the categorisation of schools into quartiles. These methodological adjustments were considered when interpreting the results and are essential for maintaining the relevance and accuracy of health surveys (Cornelius and Aday 2013). However, the potential impact on data comparability must be acknowledged. Therefore, comparisons of SE status across waves should be interpreted with caution, and future research could explore statistical harmonisation techniques to assess longitudinal trends with improved comparability. On the other hand, these updates can also enhance the robustness of the findings by incorporating more comprehensive and updated measures, ultimately contributing to the reliability and validity of the study's outcomes (Streiner et al. 2023).

Conclusions and recommendations

The study reveals a nuanced picture of the changes in mental well-being inequalities among adolescents in Barcelona during the studied period. There was a noticeable decline in mental well-being across all groups, particularly among girls. However, the reduction in mental well-being was more pronounced among initially privileged groups and not so evident for immigrants, which might reflect different coping mechanisms or community responses among marginalized and underprivileged groups in the context of broader societal stressors such as the COVID-19 pandemic. This suggests complex dynamics are at play, where historical advantages may have been compromised during the pandemic. Notably, girls from low SE status experienced a significant reduction in mental well-being, similar to their more privileged peers, indicating persistent challenges in gender-based mental health inequalities.

In view of these findings, we advocate for intersectoral and intersectionality-informed strategies and actions to promote mental health equity and equitable relationships among students (Pérez et al. 2023; Forcadell-Díez et al. 2023). International programmes like FRIENDS

for Life (Higgins and O'Sullivan 2015) and Social and Emotional Learning (SEL) initiatives, such as those promoted by CASEL (Taylor et al. 2017), have demonstrated effectiveness in enhancing emotional competence and reducing anxiety. In Catalonia, updated professional roles in school health promotion (Government of Catalonia 2024), the Mental Health National Pact (Department of the Presidency, Government of Catalonia 2023), and the Mental Health Plan of Barcelona (Department of Mental Health, Barcelona City Council 2023) highlight a growing interdepartmental commitment to equity-oriented mental health promotion. In particular, our findings support the expansion of existing initiatives such as *Salut i Escola*, the reinforcement of adolescent-focused community health agents, and stronger school–social services partnerships (Corominas et al. 2008). Moreover, the ASPB's Strategic Action Plan for Future Pandemic Preparedness explicitly integrates an equity perspective into its community and school-based mental health strategies (Pérez et al. 2024).

In line with the WHO's Health in/for All Policies framework, these recommendations emphasise the need for coordinated, intersectoral strategies that integrate adolescent mental health equity into policies across education, social services, and health systems (WHO 2014, 2024). By implementing, supporting, and evaluating these initiatives, policymakers, educators, and public health professionals can work together to mitigate mental health inequalities and promote a healthier, more equitable future for all adolescents.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10389-025-02573-3>.

Acknowledgments We are grateful to all the people and institutions who have supported the development of this work and who have contributed to making it possible, especially the Barcelona Public Health Agency (ASPB), the Barcelona Education Consortium (CEB), and the Health Service Research Group of the Hospital del Mar Research Institute (IMIM) and their professionals.

Author contribution All authors made substantial contributions to the conception or design of the work; drafted the work or revised it critically for important intellectual content; approved the version to be published; and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Funding Open Access funding provided thanks to the CRUE-CSIC agreement with Springer Nature.

Data availability The data related to the FRESC survey will be shared upon justified request. The other datasets analysed do not belong to the research team. They have been provided specifically for this study by Barcelona Education Consortium.

Code availability The code will be shared upon justified request.

Declarations

Ethics approval and informed consent The survey on which our study is based (FRESC survey) is part of the statistical actions of interest of the Government of Catalonia. Specifically, it is included in the Annual Statistical Action Program (PAAE) (adapted to Law 5/2016, of December 23, of the Statistical Plan of Catalonia 2017–2020 and amending Law 23/1998, of statistics of Catalonia) under the registration number: 09 01 03. The survey's methodological manual details the measures to guarantee the confidentiality and ethical criteria of the survey, as well as the information letters sent to schools and families. For these reasons, this study, like all those derived from this survey, does not have explicit approval from an institutional ethics committee or informed consent.

Conflicts of interest The authors have no relevant financial or non-financial interests to disclose.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Arias De La Torre J, Vilagut G, Ronaldson A et al (2023) Reconsidering the use of population health surveys for monitoring of mental health. *JMIR Public Health Surveill* 9:e48138. <https://doi.org/10.2196/48138>
- Barbayannis G, Bandari M, Zheng X et al (2022) Academic stress and mental well-being in college students: correlations, affected groups, and COVID-19. *Front Psychol* 13:886344. <https://doi.org/10.3389/fpsyg.2022.886344>
- Barcelona City Council (2023) Oportunitats educatives a Barcelona 2022. Gerència de cultura, educació, ciència i comunitat
- Barcelona City Council (2018) Distribució territorial de la renda familiar disponible per càpita a Barcelona 2016. Barcelona
- Barcelona City Council (2022) La renda de les llars a Barcelona 2019. Distribució per districtes, barris i seccions censals. Oficina Municipal de Dades. Departament d'Anàlisi., Barcelona
- Barcelona Public Health Agency FRESC Survey Data Viewer: <https://www.aspb.cat/docs/fresc/>
- Bhugra D, Bhui KS, Wong SYS, Gilman SE (eds) (2018) Oxford textbook of public mental health. Oxford University Press, Oxford
- Bitsko RH, Claussen AH, Lichstein J et al (2022) Mental health surveillance among children — United States, 2013–2019. *MMWR Suppl* 71:1–42. <https://doi.org/10.15585/mmwr.su7102a1>
- Blondé J, Easterbrook MJ, Kulich C et al (2022) Social disparities in health behaviours: the role of class-related behavioural norms and social class identification. *J Community Appl Soc Psychol* 32:302–314. <https://doi.org/10.1002/casp.2574>

- Bonal X (2012) Education policy and school segregation of migrant students in Catalonia: the politics of non-decision-making. *J Educ Policy* 27:401–421. <https://doi.org/10.1080/02680939.2011.645168>
- Bonal X, González S (2020) The impact of lockdown on the learning gap: family and school divisions in times of crisis. *Int Rev Educ* 66:635–655. <https://doi.org/10.1007/s11159-020-09860-z>
- Bonal X, Zancajo A, Scandurra R (2019) Residential segregation and school segregation of foreign students in Barcelona. *Urban Stud* 56:3251–3273. <https://doi.org/10.1177/0042098019863662>
- Boudreau B, Poulin C (2009) An examination of the validity of the family affluence scale II (FAS II) in a general adolescent population of Canada. *Soc Indic Res* 94:29–42. <https://doi.org/10.1007/s11205-008-9334-4>
- Bowleg L (2012) The problem with the phrase *women and minorities*: intersectionality—an important theoretical framework for public health. *Am J Public Health* 102:1267–1273. <https://doi.org/10.2105/AJPH.2012.300750>
- Bowleg L (2020) We're not all in this together: on COVID-19, intersectionality, and structural inequality. *Am J Public Health* 110:917–917. <https://doi.org/10.2105/AJPH.2020.305766>
- Brook MI, Bøe T, Samdal O et al (2024) Examining the psychometric properties of the family affluence scale in Norwegian health behaviour in school-aged children surveys: implications for time trend analysis. *Child Ind Res* 17:2029–2046. <https://doi.org/10.1007/s12187-024-10156-z>
- Campbell F, Blank L, Cantrell A et al (2022) Factors that influence mental health of university and college students in the UK: a systematic review. *BMC Public Health* 22:1778. <https://doi.org/10.1186/s12889-022-13943-x>
- Campbell OLK, Bann D, Patalay P (2021) The gender gap in adolescent mental health: a cross-national investigation of 566,829 adolescents across 73 countries. *SSM - Population Health* 13:100742. <https://doi.org/10.1016/j.ssmph.2021.100742>
- Castellví P, Forero CG, Codony M et al (2014) The Spanish version of the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) is valid for use in the general population. *Qual Life Res* 23:857–868. <https://doi.org/10.1007/s11136-013-0513-7>
- Clark AE, Flèche S, Layard R, Powdthavee N (2019) The origins of happiness: the science of well-being over the life course. Princeton University Press, Princeton
- Coe R (2002) What is an 'effect size'? A guide for users. *Res Capacity Build* 4
- Cohen J (2013) Statistical power analysis for the behavioral sciences. Routledge, Abingdon
- Compton MT, Shim RS (2015) The social determinants of mental health. *FOC* 13:419–425. <https://doi.org/10.1176/appi.focus.20150017>
- Cornelius LJ, Aday LA (2013) Designing and conducting health surveys: a comprehensive guide. Jossey-Bass, San Francisco
- Corominas P, Prats i Coll R, Margarita C (2008) Programa Salut i Escola. Guia d'implantació. Generalitat de Catalunya, Barcelona
- Cosma A, Stevens G, Martin G et al (2020) Cross-national time trends in adolescent mental well-being from 2002 to 2018 and the explanatory role of schoolwork pressure. *J Adolesc Health* 66:S50–S58. <https://doi.org/10.1016/j.jadohealth.2020.02.010>
- Crenshaw KW (1994) Mapping the margins: Intersectionality, identity politics, and violence against women of color
- Currie C, Alemán Díaz AY, Bosáková L, De Looze M (2024) The international family affluence scale (FAS): charting 25 years of indicator development, evidence produced, and policy impact on adolescent health inequalities. *SSM - Population Health* 25:101599. <https://doi.org/10.1016/j.ssmph.2023.101599>
- Currie C, Molcho M, Boyce W et al (2008) Researching health inequalities in adolescents: the development of the health behaviour in school-aged children (HBSC) family affluence scale. *Soc Sci Med* 66:1429–1436. <https://doi.org/10.1016/j.socscimed.2007.11.024>
- De Figueiredo CS, Sandre PC, Portugal LCL et al (2021) COVID-19 pandemic impact on children and adolescents' mental health: biological, environmental, and social factors. *Prog Neuropsychopharmacol Biol Psychiatry* 106:110171. <https://doi.org/10.1016/j.pnpbp.2020.110171>
- Department of Mental Health, Barcelona City Council (2023) II Pla de Salut Mental de Barcelona 2023–2030. Barcelona
- Department of the Presidency, Governement of Catalonia (2023) Proposal of strategies for the National Pact for Mental Health and Emotional Well-being of Catalonia 2024–2030. Barcelona
- Forcadell-Díez L, Juárez Martínez O, Abiétar DG et al (2023) Healthy and equitable interpersonal relationships, health inequalities and socio-educational interventions: a conceptual framework for action. *J Sch Health* 93:521–532. <https://doi.org/10.1111/josh.13318>
- Gibson B, Schneider J, Talamonti D, Forshaw M (2021) The impact of inequality on mental health outcomes during the COVID-19 pandemic: a systematic review. *Can Psychol Psychol Can* 62:101–126. <https://doi.org/10.1037/cap0000272>
- González S, Bonal X (2021) COVID-19 school closures and cumulative disadvantage: assessing the learning gap in formal, informal and non-formal education. *Eur J Educ* 56:607–622. <https://doi.org/10.1111/ejed.12476>
- Government of Catalonia (2024) Perfil, competències i funcions de la infermera de salut i escola, referent de salut dels centres educatius al sistema de salut de Catalunya. Barcelona
- Hartas D (2021) The social context of adolescent mental health and wellbeing: parents, friends and social media. *Res Pap Educ* 36:542–560. <https://doi.org/10.1080/02671522.2019.1697734>
- Hartley JEK, Levin K, Currie C (2016) A new version of the HBSC family affluence scale - FAS III: Scottish qualitative findings from the international FAS development study. *Child Ind Res* 9:233–245. <https://doi.org/10.1007/s12187-015-9325-3>
- Higgins E, O'Sullivan S (2015) "What Works": systematic review of the "FRIENDS for Life" programme as a universal school-based intervention programme for the prevention of child and youth anxiety. *Educ Psychol Pract* 31:424–438. <https://doi.org/10.1080/02667363.2015.1086977>
- Hoyt LT, Dotson MP, Suleiman AB et al (2023) Internalizing the COVID-19 pandemic: gendered differences in youth mental health. *Curr Opin Psychol* 52:101636. <https://doi.org/10.1016/j.copsyc.2023.101636>
- Jeriček Klanšček H, Furman L (2023) Socioeconomic deprivation and inequalities in mental well-being during the COVID-19 pandemic among adolescents. *IJERPH* 20:6233. <https://doi.org/10.3390/ijerph20136233>
- Kerekes N, Bador K, Sfindla A et al (2021) Changes in adolescents' psychosocial functioning and well-being as a consequence of long-term COVID-19 restrictions. *IJERPH* 18:8755. <https://doi.org/10.3390/ijerph18168755>
- Kern MR, Duinhof EL, Walsh SD et al (2020) Intersectionality and adolescent mental well-being: a cross-nationally comparative analysis of the interplay between immigration background, socioeconomic status and gender. *J Adolesc Health* 66:S12–S20. <https://doi.org/10.1016/j.jadohealth.2020.02.013>
- López MA, Gabilondo A, Codony M et al (2013) Adaptation into Spanish of the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) and preliminary validation in a student sample. *Qual Life Res* 22:1099–1104. <https://doi.org/10.1007/s11136-012-0238-z>
- Lotzin A, Acquarini E, Ajdukovic D et al (2020) Stressors, coping and symptoms of adjustment disorder in the course of the COVID-19

- pandemic – study protocol of the European Society for Traumatic Stress Studies (ESTSS) pan-European study. *Eur J Psychotraumatol* 11:1780832. <https://doi.org/10.1080/20008198.2020.1780832>
- Marmot M (2005) Social determinants of health inequalities. *Lancet* 365:1099–1104. [https://doi.org/10.1016/S0140-6736\(05\)71146-6](https://doi.org/10.1016/S0140-6736(05)71146-6)
- Mitchell C, Smith A (2020) The lives of girls and young women in the time of COVID-19. *Girlhood Stud* 13:v–xi. <https://doi.org/10.3167/ghs.2020.130301>
- Moreno-Agostino D, Woodhead C, Ploubidis GB, Das-Munshi J (2024) A quantitative approach to the intersectional study of mental health inequalities during the COVID-19 pandemic in UK young adults. *Soc Psychiatry Psychiatr Epidemiol* 59:417–429. <https://doi.org/10.1007/s00127-023-02424-0>
- Orben A, Tomova L, Blakemore S-J (2020) The effects of social deprivation on adolescent development and mental health. *Lancet Child Adolesc Health* 4:634–640. [https://doi.org/10.1016/S2352-4642\(20\)30186-3](https://doi.org/10.1016/S2352-4642(20)30186-3)
- O'Reilly M (2020) Social media and adolescent mental health: the good, the bad and the ugly. *J Ment Health* 29:200–206. <https://doi.org/10.1080/09638237.2020.1714007>
- Pan X (2021) Repeated Cross-Sectional Design. In: Gu D, Dupre ME (eds) *Encyclopedia of Gerontology and Population Aging*. Springer International Publishing, Cham, pp 4246–4250
- Pérez G, Artazcoz L, Jansà J, et al (2024) Pla de preparació i resposta per a futures pandèmies de l'ASPB. Accions estratègiques. Agència de Salut Pública de Barcelona, Barcelona
- Pérez G, Bartroli M, Pasarín MI et al (2023) Estrategia de promoción de relaciones equitativas y saludables en centros educativos de Barcelona. *Gac Sanit* 37:102286. <https://doi.org/10.1016/j.gaceta.2022.102286>
- Pieh C, Dale R, Jessor A et al (2022) The impact of migration status on adolescents' mental health during COVID-19. *Healthcare* 10:176. <https://doi.org/10.3390/healthcare10010176>
- Rioux C, Paré A, London-Nadeau K et al (2022) Sex and gender terminology: a glossary for gender-inclusive epidemiology. *J Epidemiol Community Health* 76:764–768. <https://doi.org/10.1136/jech-2022-219171>
- Sánchez-Ledesma E, Serral G, López M, Pérez K (2021) Manual metodològic de l'Enquesta de Factors de Risc en Estudiants de Secundària (FRESC 2021). La salut i els seus determinants en l'alumnat adolescent de Barcelona. Agència de Salut Pública de Barcelona (ASPB), Barcelona
- Sánchez-Ledesma E, Serral G, López MJ, Pérez C (2022) Manual metodològic de l'Enquesta de Factors de Risc en Estudiants de Secundària (FRESC 2021). La salut i els seus determinants en l'alumnat adolescent de Barcelona. Agència de Salut Pública de Barcelona (ASPB), Barcelona
- Schoon I, Henseke G (2022) Social inequalities in young people's mental distress during the COVID-19 pandemic: do psychosocial resource factors matter? *Front Public Health* 10:820270. <https://doi.org/10.3389/fpubh.2022.820270>
- Slade M, Oades L, Jarden A (eds) (2017) *Wellbeing, recovery and mental health*, 1st edn. Cambridge University Press
- Solar O, Irwin A (2010) *A conceptual framework for action on the social determinants of health*. World Health Organization, Geneva
- StataCorp (2023) *Stata Statistical Software: Release 17*.
- Streiner DL, Norman GR (2012) Mine is bigger than yours. *Chest* 141:595–598. <https://doi.org/10.1378/chest.11-2473>
- Streiner DL, R. Norman G, Cairney J (eds) (2023) *Health measurement scales*, 6th edition. Oxford University Press, New York
- Taylor RD, Oberle E, Durlak JA, Weissberg RP (2017) Promoting positive youth development through school-based social and emotional learning interventions: a meta-analysis of follow-up effects. *Child Dev* 88:1156–1171. <https://doi.org/10.1111/cdev.12864>
- Tennant R, Hiller L, Fishwick R et al (2007) The Warwick-Edinburgh mental well-being scale (WEMWBS): development and UK validation. *Health Qual Life Outcomes* 5:63. <https://doi.org/10.1186/1477-7525-5-63>
- the FAS Development Study Group, Torsheim T, Cavallo F et al (2016) Psychometric validation of the revised family affluence scale: a latent variable approach. *Child Ind Res* 9:771–784. <https://doi.org/10.1007/s12187-015-9339-x>
- Thomeer MB, Moody MD, Yahirun J (2023) Racial and ethnic disparities in mental health and mental health care during the COVID-19 pandemic. *J Racial Ethn Health Disparities* 10:961–976. <https://doi.org/10.1007/s40615-022-01284-9>
- World Health Organization (2001) *The World health report 2001. Mental health: new understanding, new hope*.
- World Health Organization (2024) "All for Health, Health for All" sets the stage for the Seventy-seventh World Health Assembly
- World Health Organization (WHO) (2014) *Health in all policies (HiAP) framework for country action*. Geneva
- Worldometer (2023) Worldometer's COVID-19 data in Spain. <https://www.worldometers.info/coronavirus/country/spain/>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.