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How Screen Time and Social Media Hyperconnection Have Harmed Adolescents' Relational and Psychological Well-Being since the COVID-19 Pandemic

Antonio Tintori [ID], Giulia Ciancimino *[ID] and Loredana Cerbara [ID]

Institute for Research on Population and Social Policies-National Research Council of Italy, 00185 Rome, Italy; antonio.tintori@irpps.cnr.it (A.T.); loredana.cerbara@irpps.cnr.it (L.C.)
*   Correspondence: giulia.ciancimino@irpps.cnr.it

Abstract: Following the COVID-19 pandemic, the increase in screen time and hyperconnection on social media is raising significant concerns, with particular emphasis of their effects on the relational and psychological well-being of children and adolescents. The present study analyses data from two representative cross-sectional surveys conducted among Italian adolescents in 2019 and 2022. Through bivariate analyses and binary logistic regression models, the study examines changes in screen time on social media, identifies key socio-demographic predictors of hyperconnection, and explores its effects on both the relational and psychological well-being of young people. The findings reveal the profound impact of the pandemic on daily social media use, showing a significant increase across all social groups regardless of socio-demographic characteristics, with girls consistently exhibiting higher levels of hyperconnection. Additionally, the results indicate that hyperconnected individuals are 1.4 times more likely to experience negative psychological states compared to their peers. The effects of hyperconnection vary by gender, influencing both horizontal and vertical social interactions, reducing trust in adult figures, increasing the likelihood of cyberbullying victimisation, phubbing, and body image concerns, and fostering the belief that online relationships can replace offline ones. Overall, the study highlights the urgent need for more effective prevention, awareness, and educational strategies aimed at educators, parents, and adolescents.

Keywords: hyperconnection; adolescents well-being; screen time; social media use; COVID-19 impact

1. Introduction

Over the past few years, we have witnessed an increasing use of communication technologies. The world has rapidly shifted from passive television consumption to a multifaceted blend of both passive and interactive engagement with Internet-connected electronic devices that provide access to both controlled and unfiltered contents.

As screen time (ST) has increased, the global concern about the impact of these technologies has grown, with particular emphasis on their effects on young people, often referred to as digital natives. While the advantages of technology, especially in teaching, learning, and knowledge dissemination, are evident, the problem is dual-faceted. Its darker side even suggests that the harms may outweigh the benefits. Significant concerns about the impact of screens on children's and adolescents' health arose even before the COVID-19 pandemic. Indeed, the association between increased screen time (ST) and a sedentary lifestyle, obesity, reduced sports participation, poor academic performance, and diminished cognitive and social development in childhood has been known for years (Marsh et al. 2013; Iannotti et al. 2009).

However, the negative effects of screen time on human well-being are still not fully understood. In 1970, children did not interact with media until around age 4. Today, even before the COVID-19 pandemic, they start using these technologies as early as 4 months

old (Radesky and Christakis 2016). This shift alone highlights that we are facing a new, more complex and less linear paradigm of human communication.

The formation of subjective identity is a significant aspect of this paradigm. As it is shaped by external influences, and these influences are now largely virtual rather than real, subjective identity is often structured around artificial categories. These categories are the result of the self-alteration of the identity that occurs on social media. It is therefore of fundamental importance to analyse the evolving dynamics of subjective identity formation, which appears increasingly malleable, revisable, and susceptible to manipulation over time.

While recognizing the substantial benefits that technology and social media offer, especially the ability to expand our networks of acquaintances and friendships at no cost, it is important to consider the critical issues that arise as screen time increases. There is a large body of evidence showing that early screen time negatively impacts language development and motor skills (Karani et al. 2022; Guellai et al. 2022). Additionally, it has been demonstrated that using computers and video games, unlike watching television, can lead to serious depressive symptoms and increased anxiety (Oswald et al. 2020).

Considering that the cumulative impact of screen time becomes more evident during adolescence (Oswald et al. 2020), it is crucial to analyse the attitudes and behaviours of young people at this stage of life. This analysis not only helps to understand the trajectory of this communication revolution but also to define effective interventions to support youth well-being. Furthermore, adolescence, a crucial phase for physical, cognitive, emotional, and relational development (WHO 2024), has been particularly affected by the social effects of the COVID-19 pandemic. The restrictions imposed to contain the virus led teenagers to use screens much more than before (Pandya and Lodha 2021). The COVID-19 pandemic has accelerated changes in human interaction, particularly among young people. The substantial increase in online communication has resulted in adverse effects on well-being and positive primary emotions (Deslandes and Coutinho 2020; Cerbara et al. 2020). As ST increases, social activities are being replaced by Internet use with a noticeable deterioration in personal relationships (Paez et al. 2020; Ellis et al. 2020; Minozzi et al. 2021). Additionally, the increase in the use of digital devices has not been matched by an increase in awareness of the risks of the virtual world. Instead, there has been an increase in cyberbullying episodes among younger people (Lobe et al. 2021; Ansary 2020; Kowalski et al. 2019) and emotional and self-esteem destabilisation (Tang et al. 2021; Rosenthal and Tobin 2022). In this sense, the impact of social media on well-being may vary significantly depending on the type of platform used. For instance, platforms like Instagram and Facebook, which emphasise visual content and aesthetics, have been shown to affect body image, self-esteem, and perceptions of beauty (Perloff 2014; Fardouly et al. 2015). In contrast, platforms that foster more interactive engagement, such as TikTok (version 36.2.3.), may have different effects on social interaction and psychological outcomes (Montag et al. 2021).

Based on two extensive cross-sectional surveys conducted in 2019 and 2022, with comparable representative samples of Italian adolescents (3273 and 4288 respondents, respectively), this study aims to analyse the influence of screen time and hyperconnection on social media on adolescents' well-being both before and after the COVID-19 pandemic. Due to the multifaceted nature of this phenomenon, the cross-sectional surveys include a diverse array of variables.

The goal is to offer an interdisciplinary examination of the impact of screen time on adolescents' well-being by simultaneously considering socio-demographic, psychological, and sociological factors. Furthermore, the second survey, conducted after the pandemic events, was further enriched with useful elements to investigate the psychological state of the young people interviewed, allowing for a more specific analysis of the pandemic effects related to hyperconnection.

The following hypotheses were formulated:

H1. *Physical distancing measures adopted during the pandemic have led to a widespread increase in ST among Italian teenagers, regardless of socio-demographic profiles.*

H2. *Sports practice is negatively associated with increased ST.*

H3. *The quality of horizontal and vertical interactions is negatively associated with increased ST.*

H4. *Hyperconnection is associated with lower socio-psychological well-being, which includes emotions, self-esteem, psychological distress, life satisfaction, happiness, and attitudes towards the future.*

H5. *Hyperconnected individuals have higher rates of risky online attitudes and behaviours.*

H6. *Hyperconnection amplifies the impact of social pressure on aesthetic standards, increasing the importance given to physical appearance.*

2. Materials and Methods

2.1. Sample

The current study utilises data from two national surveys conducted in Italy among adolescents attending public upper secondary schools. To ensure nationally representative samples, a two-stage stratified sampling method was implemented. Schools were randomly selected from official lists provided by the Italian Ministry of University and Research (MUR), resulting in the selection of 36 schools in 2019 and 45 schools in 2022. Within each selected school, five classes—one from each grade—were randomly chosen, amounting to a total of 180 classes in 2019 and 225 classes in 2022. This sampling strategy yielded final representative samples of 3273 respondents in 2019 and 4288 respondents in 2022, with female respondents comprising 46.3% and 41.2% of the samples, respectively. Additional demographic details about the participants are provided in Table 1.

Table 1. Samples composition across socio-demographic variables.

		2019	**2022**
		n = 3273	*n* = 4288
Sex	Male	53.7%	58.8%
	Female	46.3%	41.2%
Geographical area	South	22.9%	39.5%
	Centre	25.6%	20.0%
	Northeast	26.7%	20.1%
	Northwest	24.7%	20.4%
Class	I	20.8%	21.9%
	II	19.8%	20.6%
	III	21.4%	19.2%
	IV	19.7%	19.6%
	V	18.3%	18.7%
Citizenship	Italian	90.9%	92.7%
	Foreign	9.1%	7.3%
Type of school	Lyceum	37.2%	38.9%
	Technical institute	32.4%	31.9%
	Vocational school	30.4%	29.2%
Parental cultural status	Low	18.1%	19.6%
	Medium	53.8%	49.2%
	High	28.0%	31.2%

2.2. Procedures

Both surveys employed a semi-structured electronic questionnaire administered using the computer-assisted personal interviewing (CAPI) method. The presence of research team members in classrooms during the administration process ensured data reliability,

as it helped clarify questions and ensured comprehensive responses, resulting in zero missing data and minimising potential teacher influence bias. The questionnaires comprised 57 questions in 2019 and 77 questions in 2022, covering a wide range of dimensions, including socio-economic family background, demographic details, family and friendship dynamics, lifestyle choices, leisure activities, both offline and online interactions, social media usage patterns, deviant behaviours, belief systems, values, trust in relationships and institutions, and individual well-being. This study received ethical approval from the Research Ethics and Integrity Committee of the Italian National Research Council on [approval date: 22 July 2021]. Informed consent was obtained from all participants and their legal guardians, emphasising the anonymous nature of participation. All procedures followed in this study adhered strictly to applicable guidelines and regulations governing research ethics.

2.3. Measures

Hyperconnection: Respondents were asked to indicate the frequency of their daily social media usage. During the recording process, the original data were categorised into four distinct levels of screen time on social media: absent, for individuals who do not engage with social media; low, for those whose usage is between thirty and sixty minutes per day; medium, for participants who spent one to three hours daily on this platform; and high, for those whose social media engagement exceeds three hours each day. Subsequently, this variable was dichotomised to differentiate between participants with elevated screen time—labelled as hyperconnected—and all others.

Negative individual well-being: This variable, constructed using multiple correspondence analysis (MCA), aggregates information from six variables each reflecting various psychological dimensions, such as self-esteem, psychological distress, intensity of negative primary emotions, happiness, satisfaction, and attitudes towards the future. The resulting variable was dichotomised to distinguish between respondents experiencing negative individual well-being (score 1) from those with positive well-being (score 0). The following sections detail the specific measures used to develop the negative individual well-being variable:

- Self-esteem: Respondents' self-esteem was evaluated using the Rosenberg self-esteem scale, a widely validated tool in social science research (Rosenberg 1965). This scale measure individuals' positive or negative perceptions of themselves categorising self-esteem into low, healthy, and high levels. The distribution of 'desirable' scores is centred around the middle of the scale, reflecting its non-linear nature.
- Psychological distress: Anxiety and depressive symptoms were assessed using the Kessler scale of psychological distress (K10) (Kessler et al. 2002). The scale includes ten items rated on a five-point scale, capturing the frequency of symptoms such as nervousness, sadness, restlessness, hopelessness, and feelings of worthlessness. The cumulative score, ranging from 10 to 50, was used to define four levels of psychological distress: absent, low, moderate, and high.
- Intensity of negative primary emotions: The intensity of negative primary emotions was measured using a seven-point scale, where 1 represented the lowest and 7 the highest intensity perceived, focusing on three emotions: anger, sadness, and fear. The mean score was calculated to create an indicator, subsequently used to classify participants into three categories based on the intensity of these emotions: high, medium, and low.
- Happiness and satisfaction: These variables measured respondents' perceptions of their happiness (H) and satisfaction (S) using a Cantril scale ranging from 1 (indicating the lowest level) to 10 (indicating the highest). During data recording, scores were grouped into three categories: low (1–6), medium (7–8), and high (9–10), reflecting distinct levels of perceived happiness and satisfaction.
- Attitudes towards the future: This measure assessed pessimistic and uncertain outlooks on the future through two statements: "I hold a positive outlook on the future"

and "My future appears uncertain" both rated using a 4-point Likert scale. The final index is a binary variable where a score of 1 identifies respondents who exhibit negative attitudes towards the future and a sense of uncertainty.

Negative peer relationships: This variable resulted from applying principal component analysis (CATPCA) to categorical variables (see Section 2.4). The original set of four variables included friendship network size, friendship satisfaction, trust in close friends, and weekly frequency of in-person meetings with friends. To use this variable as a dependent variable in logistic regression models, it was dichotomised with 1 identifying respondents with negative peer relationships, characterised by low trust in their friends, a small friendship network, infrequent in-person meetings with friends, and low satisfaction derived from peer relationships. Each variable employed is described below:

Peer friendship network size: Respondents indicated the number of their close friends by selecting from four options: zero, one to three, four to six, and more than six.

Frequency of in-person meetings with friends: Respondents reported how often during a week they met their friends using a 4-point scale: 'never', 'once a week', 'two or more times a week', and 'every day'.

Friendship satisfaction: Participants rated their satisfaction with their friends on a 4-point scale ranging from 'not at all' to 'very much'.

Trust towards friends: Respondents indicated the perceived level of trust in their friends on a 4-point scale ranging from 'not at all' to 'very much'.

Low trust in adult figures: This variable was obtained using principal component analysis (CATPCA) applied to categorical variables (see Section 2.4). The multivariate method synthesised information from variables related to the level of trust expressed by adolescents towards adult figures of reference. Specifically, the original set of four variables included respondents' relational trust towards their father, mother, other family members, and teachers. Respondents indicated their level of trust in each of these figures on a 4-point scale, ranging from 'not at all' to 'very much'. To use this variable as a dependent variable in logistic regression models, it was dichotomised, with 1 identifying respondents having a low level of trust towards their parents, other family members, and teachers.

Risky online attitudes and behaviours: This variable resulted from applying principal component analysis (CATPCA) to categorical variables (see Section 2.4). The original set of four variables included phubbing, perceived sincerity of virtual interactions, perceived usefulness of face-to-face dialogue, and substitutability of face-to-face relationships with virtual ones. These behaviours and attitudes were assessed through four statements, where respondents indicated their level of agreement on a four-point scale ranging from 'strongly agree' to 'strongly disagree'. The resulting variable was dichotomised in order to carry out logistic regression models, identifying adolescents who exhibit behaviours such as avoiding interruption online, believing virtual interactions are more sincere than face-to-face interactions, considering face-to-face dialogue useful only for non-social media users, and believing virtual relationships can replace face-to-face ones.

Body dissatisfaction: Respondents were asked to express their satisfaction with their bodies at the time of the interview. For the purposes of logistic regression analysis, this variable was transformed into a binary variable, with 1 indicating body dissatisfaction and 0 body satisfaction.

Cyberbullying victimisation: The extent of cyberbullying victimization was evaluated by presenting participants with a list of potential online behaviours they might have encountered. Respondents were asked to report how often they had experienced these actions in the past year on a four-point scale ranging from "never" to "always". The list included actions such as insults, teasing, threats, exclusion from groups, and unauthorised sharing of personal photos or videos. The data were then recorded into a binary variable with 1 identifying victims of cyberbullying, individuals who reported experiencing at least one of these actions frequently or always.

2.4. Data Analysis

The data analysis was carried out using SPSS software (version 28, IBM, Chicago, IL, USA) through multiple stages employing various methods. In the first stage, a univariate analysis was conducted to observe the frequency of time spent on social media and its variation between 2019 and 2022. Subsequently, we observed the changes over time in the distribution of hyperconnectivity across the main socio-demographic variables.

In the second stage, aiming to identify the main predictors of hyperconnectivity, we conducted a logistic regression analysis examining the impact of key socio-demographic variables on the likelihood of being hyperconnected, comparing 2019 and 2022.

In the third stage of the analysis, we used only the 2022 data to delve deeper into the post-pandemic scenario. Initially, we synthesised some variables related to the respondents' relational and individual well-being using principal component analysis for categorical variables (CATPCA) to create more robust measurement tools. The synthesis focused on three distinct groups of variables: trust in adult figures, peer relationships, and risky online attitudes and behaviours. After examining explained variance and total inertia, the primary components were selected. For each of these groups, the first component was selected, with explained variances of 54.3%, 49.7%, and 34.2%, respectively (Supplementary Materials). The measure of individual well-being was obtained from the first component resulting from the application of multiple correspondence analysis (MCA) (Tintori et al. 2023). This psychological well-being component accounted for 93% of the explained variance. To apply binary logistic regression models, we dichotomised these four components, selecting the lowest quartiles to identify adolescents with low trust in adult figures, poor relational well-being with peers, adopting risky online attitudes and behaviours, and negative individual well-being. For detailed information on the synthesised variables, refer to the Measures section.

In the fourth and final stage of the analysis, aiming to examine the impact of hyperconnection on relational and individual well-being, we conducted binary logistic regression models. The models were repeated separately by gender, offering a deeper understanding of these dynamics. In each analysis, hyperconnection served as the independent variable, while dependent variables included the following key aspects of adolescents' well-being: individual well-being, trust in adult figures, peer relationships, risky online attitudes and behaviours, body dissatisfaction, and cyberbullying victimisation.

The logistic regression model employed in both the second and fourth phases of the analysis tests the null hypothesis (H0), which posits no statistical relationship between the dependent variable (y) and the predictor variable (x). Specifically, this null hypothesis is expressed as H0: $\beta = 0$, suggesting that the predictor variable x does not affect the probability of the dependent variable y occurring P (y = 1). To test H0, we applied a Z-test, which entails dividing the maximum likelihood estimate of β by its standard error. This quotient, known as the Wald statistic, is distributed according to a chi-square distribution.

During the second phase, we used a forward selection method to identify statistically significant variables. This step-by-step procedure begins by calculating the chi-square score statistic for each potential predictor not yet included and then identifies the highest of these statistics. If this maximum score is statistically significant at the 0.05 level, the associated predictor is added to the model. Once a predictor is included, it remains in the model and is not removed during the subsequent steps. The process repeats until no additional predictors meet the specified entry criteria. For each element added to the model, we analysed the maximum likelihood estimates of its parameters and evaluated their statistical significance.

3. Results

Table 2 displays the frequencies of daily time spent on social media by Italian adolescents in 2019 and 2022. The comparison highlights a clear trend towards increased usage over the years, especially following the pandemic. In 2019, most adolescents reported spending up to 2 h daily on social media (54%). By 2022, responses shifted towards higher

usage categories and those spending more than 4 h per day increased from 11.0% to 21.0%. In particular, the proportion of adolescents spending from 3 to more than 4 h a day on social media, classified here as hyperconnected (see Measures section), nearly doubled from 23.1% to 39.4%.

Table 2. Daily time spent on social media in 2019 and 2022 (*n*).

	2019 (*n* = 3273)	2022 (*n* = 4288)
Absent	2.7% (88)	1.0% (45)
Up to 30 min	7.0% (230)	3.7% (157)
From 30 to 60 min	16.4% (536)	10.4% (447)
From 1 to 2 h	28.3% (925)	21.4% (917)
From 2 to 3 h	22.5% (738)	24.0% (1031)
From 3 to 4 h	12.1% (396)	18.4% (789)
More than 4 h	11.0% (360)	21.0% (902)

Table 3 reveals the changes in the proportion of hyperconnected adolescents (those spending more than 3 h a day on social media) from 2019 to 2022 across key socio-demographic variables: gender, geographical macro-area, citizenship, type of school, class attended, and sport participation. In terms of gender, in 2019, 29.6% of females were classified as hyperconnected, compared to 17.5% of males. By 2022, these figures had increased by 22.6% for females and by 13% for males. Hyperconnection also varied by Italian geographical macro-area. In both 2019 and 2022, the South had the highest proportion of hyperconnected adolescents, with an increase of 12.3%. The regions of the Centre and the Northwest saw larger increases of 16.7% and 17.5%, respectively. The Northeast, while still the lowest, also saw an increase of 14.2%.

Table 3. Frequencies of hyperconnection across socio-demographic variables in 2019 and 2022 (*n*).

		Hyperconnection	
		2019	2022
Sex	Female	29.6% (449)	52.2% (923)
	Male	17.5% (307)	30.5% (768)
Geographical area	South	31.3% (235)	43.6% (737)
	Centre	25.5% (214)	42.2% (362)
	Northeast	19.0% (166)	33.2% (287)
	Northwest	17.4% (141)	34.9% (305)
Citizenship	Italian	22.9% (682)	39.1% (1555)
	Foreign	24.7% (157)	43.5% (410)
Type of school	Lyceum	20.1% (245)	36.1% (601)
	Technical institute	21.8% (231)	36.6% (502)
	Vocational school	28.1% (280)	47.0% (588)
Class	I	22.4% (153)	38.5% (362)
	II	21.9% (142)	40.8% (361)
	III	23.6% (165)	39.8% (327)
	IV	24.8% (160)	39.0% (328)
	V	22.7% (136)	39.1% (313)

Looking at citizenship, in both years, the proportion of hyperconnected adolescents was slightly higher among foreigners than Italians, with the gap increasing slightly from 1.8% to 4.4%. Vocational school students had the highest rates of hyperconnection in both 2019 and 2022, with the largest growth increasing by 18.9%. Technical institute students followed (+14.8%), while lyceum students were the least hyperconnected (+16%). Lastly, the proportion of hyperconnected adolescents grew evenly across all class levels. However, while in 2019, the most hyperconnected were those attending the fourth year (aged between 17 and 18 years), in 2022, the highest proportion was among second-year students (aged between 15 and 16 years).

3.1. Results of the Logistic Regression Analysis with Hyperconnection as Dependent Variable

The first logistic regression carried out examines the impact of various socio-demographic variables on the likelihood of being hyperconnected, comparing pre- and post-pandemic periods (2019 and 2022 datasets) confirming the results observed in Phase 1 of the analysis. As shown in Table 4, males are less likely to be hyperconnected compared to females, as well as respondents from the Northeast and Northwest regions compared to those from the South of Italy. Conversely, students from technical and vocational schools are more likely to be hyperconnected than those from lyceums, while engaging in sports reduces the likelihood of being hyperconnected. However, the most influential variable is time, with the likelihood of being hyperconnected doubling from 2019 to 2022. Finally, the results show that citizenship and the year of school attended do not significantly influence hyperconnection. For detailed results, please refer to Supplementary File S2.

Table 4. Logistic regression results: Socio-demographic factors influencing hyperconnection in 2019 and 2022.

Independent Variable (Reference Category)	Odds Ratio	CI (Lower)	CI (Upper)
Year (2022)	2.204	1.981	2.453
Sport participation (Yes)	0.732	0.659	0.813
Geographical area (Northwest)	0.641	0.557	0.737
Geographical area (Northeast)	0.605	0.525	0.697
Type of school (Technical school)	1.316	1.159	1.495
Type of school (Vocational school)	1.545	1.366	1.748
Sex (Male)	0.454	0.408	0.506

3.2. Results of the Logistic Regression Analysis with Hyperconnection as Independent Variable

The regression analyses systematically examined how hyperconnection impacts various dimensions of adolescent well-being. Separate models were conducted by sex to provide deeper insights. Hyperconnection was treated as the independent variable, with dependent variables including negative psychological well-being, trust in adult figures, peer relationships, risky online behaviours, body dissatisfaction, and cyberbullying victimisation. The odds ratios of significant results are presented in Table 5, with detailed regression model outcomes in Supplementary File S2.

The findings indicate that hyperconnection compromises adolescents' psychological well-being. Both genders showed a 1.4 times increased likelihood of negative psychological states. Regarding trust in adults, hyperconnection increased the likelihood by approximately 1.3 times among both sexes in perceiving low trust towards parents, family members, and teachers. Among females, hyperconnection significantly affected peer relationships, reducing the likelihood of negative relationship experiences by about 30%. In terms of risky online behaviours, hyperconnection increased the likelihood by approximately 2 times for girls and 1.5 times for boys. Body satisfaction was negatively impacted by hyperconnection, increasing the likelihood of dissatisfaction by about 1.4 times for both genders. Lastly,

hyperconnection increased the likelihood of cyberbullying victimisation among females by approximately 1.4 times.

Table 5. Logistic regression results by sex. Impact of hyperconnection on aspects of individual and relational well-being in adolescents.

Dependent Variable	Sex	Odds Ratio	CI (Lower)	CI (Upper)
Negative psychological well-being	Females	1.397	1.12	1.743
	Males	1.414	1.169	1.711
Low trust in adult figures	Females	1.283	1.054	1.562
	Males	1.298	1.069	1.576
Negative peer relationships	Females	0.705	0.578	0.86
Risky online attitudes and behaviours	Females	2.003	1.6	2.507
	Males	1.533	1.269	1.853
Body dissatisfaction	Females	1.440	1.191	1.741
	Males	1.434	1.203	1.71
Cyberbullying victimisation	Females	1.379	1.106	1.72

4. Discussion

The data clearly show a substantial increase in time spent on social media and hyperconnection among Italian adolescents between 2019 and 2022. These increases are evident across all socio-demographic variables, highlighting the significant impact of the COVID-19 pandemic on social media usage habits and confirming the validity of H1. However, the increase in hyperconnection shows higher rates among specific social groups, such as women, students in vocational institutes, and respondents from Southern Italy, without being dependent on age or citizenship. While it is a widespread issue among young people, socio-demographic differences may stem from distinct factors: varying socialisation practices in Italy that emphasise different levels of direct community engagement as well as family, cultural, and economic characteristics. Sex consistently emerges as the most distinguishing socio-demographic variable in this context. This result reflects not only differences in socialisation, levels of prosocial behaviour, and tendencies of listening and communicating with other people (Tintori et al. 2021), but also the social pressures to conform to behavioural, participatory, and image norms that offer recognition and are perceived as successful.

Furthermore, according to the bivariate results, the age of hyperconnection shows a declining trend: in 2019, the most hyperconnected were those attending the fourth year (aged between 17 and 18 years), and in 2022, the highest proportion was among second-year students (aged between 15 and 16 years). The results of the logistic regression with hyperconnection as the dependent variable—aimed at measuring the impact of socio-demographic variables on the probability of being hyperconnected—confirm the findings of the bivariate analysis showing that the most significant variable is time: in less than 3 years, the number of hyperconnected individuals nearly doubled overall (from 23.1% to 39.4%). These analyses fully confirm the validity of H1.

H2 was also confirmed by the logistic regression model. However, it is necessary to underline that playing sports only slightly reduces the probability of being hyperconnected. This suggests that while physical activity may offer some respite from social media engagement, its impact is not strong enough to counteract the broader trend of increasing hyperconnection.

H3 is only partially supported. The logistic regression models with hyperconnection as the independent variable reveal a mixed impact on the quality of both horizontal and vertical social interactions. On the one hand, hyperconnection is associated with a lack of trust in adult figures for both girls and boys; on the other hand, other results differentiate the impact of the phenomenon by sex. Indeed, teens' engagement in risky online attitudes

and behaviours is significantly influenced by hyperconnection, with girls being twice as likely to engage in this type of behaviour. Likewise, hyperconnection increases the likelihood of cyberbullying victimisation, particularly among girls. Likely due to their different use of social media compared to boys, girls positively differ in peer interactions: hyperconnection has a beneficial impact on their friendships, enhancing both the quantity and quality of these relationships.

Differently, hyperconnection clearly and negatively influences various dimensions of adolescent psychological well-being both for boys and girls. This conclusion is drawn from the logistic regression model with the variable obtained from the multiple correspondence analysis (MCA) synthetising self-esteem, psychological distress, intensity of primary negative emotions, happiness, satisfaction, and attitudes towards the future. The results reveal a 1.4 times greater probability of experiencing a negative psychological state for both boys and girls as a consequence of hyperconnection. This finding validates H4 and aligns with numerous longitudinal and cross-national studies which collectively demonstrate consistent global patterns of negative psychological effects associated with excessive screen use and hyperconnection (Boer et al. 2021; Vannucci et al. 2017; Athanasiou et al. 2018; Plackett et al. 2023). H5 is also validated. Hyperconnection reduces tolerance for disconnection (phubbing) when adolescents transition abruptly from the virtual to the real world, affecting both sexes. Additionally, it shapes attitudes and behaviours in the virtual realm, reinforcing beliefs in greater sincerity in online relationships compared to face-to-face interactions, the notion that direct dialogue is only valuable for those who do not use social media, and the belief that virtual relationships can supplant offline ones.

Lastly, hyperconnection amplifies the impact of social pressure on aesthetic standards, increasing the importance of physical appearance. This finding, observed in both boys and girls, validates H6. The heightened focus on physical appearance likely stems from the constant exposure to idealised images and standards on social media platforms, which can lead to increased body dissatisfaction and a stronger emphasis on meeting these societal expectations.

This study has several limitations, primarily due to the complexity and novelty of the phenomenon under analysis. First, it lacks specific data on the types of social media used by adolescents, relying instead on quantitative measures of usage frequency. Additionally, it precludes a comparative analysis of psychological states between the two cross-sectional surveys. The inclusion of individual status variables in the second wave became necessary due to emerging psychosocial effects related to the COVID-19 health crisis, with attention to these variables only introduced after 2020. Moreover, comparative analyses between 2019 and 2022 data involved distinct, independent samples since respondents were not the same individuals in both waves. This approach was taken to ensure the anonymity of the interviewees, crucial for mitigating biases related to social desirability and safeguarding the right to privacy.

5. Conclusions

It appears evident that a society without social media, the influence of artificial intelligence on our lives, and widespread online interaction is no longer conceivable. However, it is increasingly crucial to understand how this transformation affects our face-to-face relationships, influencing both our psychological and relational well-being. In this regard, emphasis must be placed on ST but first of all on the quality of social media usage. Given the importance of screen time, it is essential to establish updated thresholds for hyperconnection, paying attention to different age groups. To achieve this aim, increasingly sophisticated collection and analysis methods should be employed in line with technological advancements.

In this context, the significance of spatial relativism must also be acknowledged. It has been established that there are substantial cultural variations among populations in terms of quantity and quality of interpersonal interactions, which can lead to different effects on individual well-being when face-to-face interactions are reduced. For instance,

the American Academy of Pediatrics has highlighted concerns regarding children's media use, cautioning against its potential to replace essential offline world experiences (AAP 2016). Nonetheless, establishing "prudent" and universal thresholds for hyperconnection, tailored to pre-adolescents, adolescents, and adults, remains challenging yet essential.

Four years after the onset of measures to address the COVID-19 pandemic, it is imperative to identify more effective strategies for prevention, awareness, and education regarding the risks of hyperconnection. These strategies should be implemented extensively across national territories involving educators, parents, and young people in training initiatives. Given the increasing impact of technology on social interactions and its consequences on psychological well-being, urgent actions are needed to establish new educational policies and public health campaigns. It may also be appropriate to set limits on daily social media use while promoting sports and the importance of face-to-face relationships and activities, which cannot be replaced by virtual connections. To mitigate the adverse effects of excessive screen time, it is essential to enhance parental awareness of the risks associated with hyperconnection. This can be achieved by organizing regular meetings between parents of nursery school children and specialists in hyperconnection and parental control. Strengthening parental competencies regarding Internet addiction through the dissemination of national guidelines and accredited intervention protocols is also recommended. Pediatricians and early childhood education services should play a key role in promoting the mindful use of digital devices. The concept of the "educational community" should be embraced as a framework for combating hyperconnection. Developing territorial networks and community educational pacts is crucial for disseminating information, sharing knowledge, and encouraging youth engagement. Additionally, supporting school teachers with mandatory training on hyperconnection, Internet addiction, virtual behaviour, cyberbullying, and related teaching and communication strategies is important. While recognizing the undeniable benefits of modern IT devices, these interventions aim to promote a responsible use of the Internet and social media. Despite the challenges posed by digital tools, they also enhance communication among family members, provide vast learning opportunities, and offer a broader perspective on global cultures and social diversity.

Research and implementation of interventions to support young people's well-being are crucial not only to address the effects of hyperconnection and increasing social withdrawal among adolescents (Barzeva et al. 2019) but also to guide the responsible use of essential digital tools. Future research should focus on understanding the dynamics and effects of hyperconnection more deeply, with an emphasis on longitudinal studies and cross-national comparisons.

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the statistical data analysis. A.T. did the psychosocial interpretation of results. A.T. is also the first author of this paper. L.C. is the last author, i.e., the group leader in this research. A.T., G.C. and L.C. contributed to the paper's review. All authors have read and agreed to the published version of the manuscript.

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