

*Original Research***Adolescence and COVID-19: Traumatic Stress and Social Distancing in the Italian Epicenter of Pandemic**Chiara Maiorani<sup>1,\*</sup>, Isabel Fernandez<sup>2</sup>, Vito Tummino<sup>3</sup>, Daniela Verdi<sup>4</sup>, Eugenio Gallina<sup>1</sup>, Marco Pagani<sup>5</sup><sup>1</sup>EMDR Italian Association, 20814 Varedo, Italy<sup>2</sup>EMDR Europe and Association EMDR Italy, 20814 Varedo, Italy<sup>3</sup>Clinical Psychology Department, St Anna Hospital, 22100 Como, Italy<sup>4</sup>Italian Ministry of Education, 0153 Rome, Italy<sup>5</sup>Institute of Cognitive Sciences and Technologies of the National Research Council (CNR), 00185 Rome, Italy\*Correspondence: [chiaramaiorani@gmail.com](mailto:chiaramaiorani@gmail.com) (Chiara Maiorani)

Academic Editor: Pasquale Calabrese

Submitted: 25 March 2022 Revised: 7 May 2022 Accepted: 11 May 2022 Published: 15 August 2022

**Abstract**

**Introduction:** The spread of the COVID-19 Pandemic led the Italian government to impose restrictive measures. Schools were closed and the organization of Distance Learning (DL) made adolescents face the psychological impact of the pandemic and the loss of their social life. **Objective:** This research aimed to evaluate the psychological impact of the COVID-19 Pandemic and DL on students, attending two high schools in the Lodi area (Lombardy, Italy). **Method:** A questionnaire, composed of PSYCHO-COVID 19 and EMOTION THERMOMETER applied to DL, was administered anonymously through the Google Drive School platform, from May 5th to June 5th 2020. **Results:** Analysis of the protocols revealed stress reactions in 35% of students (12% High, 7% Moderate, 16% Mild). Principal Components Analysis also revealed the presence of a “distress entity” characterized by anxiety, depressive and somatic symptoms (comparable to those of post-traumatic stress syndrome), with a greater impact on females. The analysis of data on DL showed that online teaching was experienced negatively, in an almost linear correlation, by those subjects who had expressed distress. **Conclusions:** The results suggest that the pandemic had a traumatic impact on adolescents, especially on girls; psychological distress negatively influenced individual experiences with DL. Appropriate psychotherapeutic interventions are needed to prevent the chronicization of stress reactions and to facilitate the adaptation of adolescents to possible rapid changes in educational management.

**Keywords:** COVID-19; mental health; adolescents; distance learning (DL)**1. Introduction**

The COVID-19 pandemic, along with the multilevel restrictive measures applied, has generated a situation in the biomedical and socioeconomic environment that is unpredictable and stressful. The spread of disease introduced real threats as well as unintentional and drastic changes in daily lifestyle with financial difficulties and uncertain future prospects. In addition to this, pandemic minimized the possibility of implementing functional coping strategies and stress management. This combination of stressors can lead to both acute and long-term adverse effects, both direct and indirect and ultimately transgenerational. All of these stressors have physical and mental health consequences [1].

In a greek study [1], the authors described the dramatic effects of the pandemic and aimed to improve the assessment of the emotional, behavioral, and social impact of COVID-19 across nations through a holistic approach.

The spread of the Sars-Cov 2 virus has affected most nations and their governments have faced a state of emergency based on limited scientific data. The most common strategy has been social distancing through forced quarantine and widespread closures, including schools. This led to

physical isolation, economic instability, fear of contagion, and uncertainty about the future. These aspects have profoundly affected global mental health [2,3].

Restrictive measures had a widespread impact on social, relational and emotional life; in fact, due to distance learning (DL), there was also an effect on students' academic achievements and access to mental health services [4]. Previous research reveals that during Pandemic, as in any other disaster, there is an increase of post traumatic stress symptoms (PTSD), depression and anxiety [5] and suicidal risk [6]. The governmental measures also generated a worldwide economic crisis.

Inevitably, COVID-19 will have serious and potentially long-lasting implications for the mental and physical health of children and caregivers as well as their long-term development [7]; the literature indeed, points out that although developmental age subjects were not severely affected by the infection, the psychological impact was intense [8].



Children and adolescents lived a long physical distancing from peers, teachers, extended families and community and it is known that subjects in developmental age who experienced quarantine have a higher risk to develop PTSD and anxiety symptoms [9].

Quarantine can be an unpleasant experience for those who have to face it; in fact separation from loved ones, the loss of freedom, uncertainty over disease status, and boredom may have dramatic outcomes. Suicide, substantial anger and lawsuits were reported to have followed the imposition of quarantine in previous outbreaks [2].

According to literature, adolescence is a critical developmental stage in which peer relationship and experience outside the family are important to shape personal identity. The brain and the social environment sculpt each other throughout the teenage years to influence one's social standing amongst peers. Reciprocal interactions between brain maturation and the social environment at this critical developmental stage may augment risk or promote resilience for mental illness and other health outcomes [10].

For adolescents, furthermore, the level of stress may be heightened [11] due to their increased desire for autonomy and peer connection [12], which are both hindered when they are forced to physically distance from friends and remain home. It is also necessary to consider adolescents' underdeveloped cognitive mechanisms that on one hand inhibit, or at least restrict self-regulation [13] and, on the other hand favour an increase in mental health issues during this developmental stage [14].

The COVID-19 pandemic is having a psychological impact on specific populations [15,16], indeed especially adolescents with a psychiatric history are at a particular risk. Adolescent girls and adolescents living in lower economic status families may be more vulnerable. Other studies show that more vulnerable populations (women, ethnic minorities, and low-income households) worry more when they have to face crises [17].

Likely, in the future, mental health professionals may face a "Syndemic" due to the spread of acute and post-traumatic stress disorder, emotional disorders, sleep disturbances, depressive syndromes, and eventually suicide [18].

It is also necessary to consider the negative impact of restrictive measures on global health. When children are confined to their homes without outdoor activities and interaction with same age friends [19], they are physically less active, have much longer social-media screen time, irregular sleep patterns, and less favourable diets, resulting in weight gain and loss of cardiorespiratory fitness. It is also important to take into account medium and long term consequences on global health. The ACE (Adverse Childhood Experiences) Study [20,21] revealed a strong connection between traumatic and chronic experiences during childhood and adolescence and psychophysical disease in adulthood. In particular, a strong correlation was found between the exposure to household dysfunction or abuse dur-

ing childhood and multiple risk factors for several of the leading causes of death in adults, including ischemic heart disease, cancer, chronic lung disease, skeletal fractures, and liver disease.

Another study indicates that some adverse childhood experiences notably those related to parental health, may leave imprints on peripheral DNA methylation that persist to mid-life [22]. Methylation is precisely the major epigenetic mechanism regulating tissue-specific gene expression, genomic imprinting, and X chromosome inactivation.

These studies highlight how important the diagnosis and the treatment of COVID 19 trauma are in perspective of protective policies of the global health of the population.

### *1.1 The Pandemic and Adolescents*

Some of the research on mental health during the pandemic focuses on the psychological impact in developmental age.

A longitudinal study on the psychological impact of the COVID-19 Pandemic in Australian adolescents and their parents showed a worsening of mental health in adolescents, revealing an increase in depressive and anxiety symptoms, a significant decrease in life satisfaction, particularly among girls. Additional analyses revealed that COVID-19 correlates with worry, online learning disabilities, and increased conflicts with parents, while adherence to mandatory quarantine and feeling socially connected were described as protective factors [23].

A longitudinal study of the general population conducted in China concluded that extended closure had several negative effects. The greatest psychological impact was found in the 12–21 age group, who faced extended school closures and distance learning classes [19]. This study also revealed the presence of somatic symptoms prompting researchers to consider the psychoneuroimmunological (PNI) implications of COVID-19. Sars-Cov 2 can cause acute respiratory syndromes resulting in the release of pro-inflammatory cytokines, including interleukin (IL)-1 $\beta$  and IL-6 from the respiratory tract [24]. An over-expression of these cytokines has been found in major depressive disorder [25,26] and functional somatic syndromes [27], thus indicating that COVID-19, depression, and functional somatic syndrome may share the same PNI framework. This encourages consideration of appropriate psychotherapeutic techniques to reduce depressive and somatic symptoms.

These results were corroborated by related research conducted in the United States, confirming the increase in negative mental health symptoms among young adolescents in North Carolina [28].

In Europe, a study conducted in Lithuania, with the collaboration of seven schools, found a significant negative impact of the COVID-19 pandemic on mental health in most adolescents, such as a significant increase in hyperactivity/attention, emotional symptoms, and conduct prob-

lems; furthermore, one in five adolescents experienced more problems with their peers (peer-problems group) [29].

An Italian study in a pediatric population, including children and adolescents with neuropsychiatric disorders, shows that emotional and behavioral symptoms are significantly increased during quarantine. Several demographic and clinical characteristics (male sex, residence in highly affected areas, parental job loss, parental education level, and autism spectrum disorders) appear to be associated with an increased risk of psychological consequences. In addition, social isolation has generated significant changes in the lifestyle of the population. Hence, while several factors, as the presence of siblings, time spent on physical activity, talking to other people, were found to be protective for mental health, other factors, like using a smartphone, watching television/series/movies on digital devices, or time spent on social media or chatting were found to elevate the risk [30].

### 1.2 The Lodi Area

The Lodi area was the epicenter of the Sars-Cov 2 Pandemic in Italy and Europe. In the night between Thursday 20 and Friday 21, February 2020, the first diagnosis of COVID-19 was made on a young adult patient in the Codogno emergency room. It was the first outbreak in Italy of an epidemic, which had already claimed victims in China [31]. The first restrictive measure was the creation of a “Red Zone” where schools and all non-essential services were closed on the same Friday morning.

Following the Lockdown, the Headmaster of the two high schools, “Pandini” and “Piazza”, focused on making Distance Learning (DL) activities accessible, including a “psychological service”. The Headmaster, together with the school psychologist agreed to set up a questionnaire for the students to be filled remotely through the Google Drive platform. Based on this setting, the objectives of the study were to assess the impact of the COVID-19 Pandemic on the students’ mental health, in order to identify the needs of psychosocial support and to plan future targeted interventions and to receive a feedback from the students on how they were experiencing Distance Learning.

## 2. Materials and Methods

### 2.1 Research design

#### 2.1.1 Participants

N = 930 participants were included in the study; n = 480 students were enrolled from the Pandini-Institute and n = 450 students from the Piazza-Institute.

#### 2.1.2 Procedure

Participation in the survey was free and voluntary and the participants were not remunerated. Each student (or the parents of underage students) received an Informed Consent, which they were requested to sign, stating that the data would be used for research purpose only and would be processed in conformity with the European Privacy Law (EU

Regulation 2016/679 and Privacy Code D.Lgs 101/2018).

The questionnaires were introduced to students, teachers and parents with a video, in which the school psychologist explained the study and its purposes. They were then administered anonymously and the data was collected through the Google Drive platform from May 5th to June 5th 2020.

Subsequently the school psychologist organized for parents and teachers a meeting on stress management after critical events, in order to improve in adult caregivers the skill to understand and support their sons and daughters and students [32].

#### 2.1.3 Assessment Tools

A general data entry consisted of sociodemographic (age, gender, institution) and COVID19-related information (e.g., quarantine, symptoms, hospitalization, infection status and hospitalization of participants and loss of a friend, loss of a relative).

The questionnaire consisted of two main tools: THE PSYCHO-COVID 19 and the EMOTION THERMOMETER.

The PSYCHO-COVID 19 Questionnaire is a self-assessment of psychological distress. The scale is made up of 20 items, each defining a range of problems, states of psychological and physical distress caused by the situation related to the risk of contagion by Coronavirus, by social distancing, by having to discontinue one’s ordinary routine, by staying at home in isolation, by limitation of motor activities and/or by hospitalization.

The questionnaire considers psychological as well as somatic features, which are assumed to interact with behavior in stress situations. Besides the possibility to assess a person’s level of distress, the questionnaire serves also as an indicator to practitioners, to plan tailored interventions.

An Italian and an English version of the questionnaire is available on the website of the Provincial Health Authority of Ragusa (<http://www.psycho-covid19.it>). A preliminary validation study based on n = 1369 respondents demonstrated a high reliability with Cronbach’s Alpha of 0.923 (95% Confidence Interval: 0.917, 0.928) and an average effect size of 0.38 (Paper in Progress).

The EMOTION THERMOMETER (ET) is a five-domain visual-analogue scale assessing the self-perceived intensity of four mood-domains (distress, Anxiety, Anger, Depression) as well as “need for help” [33,34].

The scale was used to measure the level of negative emotions relative to DL. Additionally, the dimension “Joy” was added to the six items of the scale, in order to counterbalance for negative attitudes of the students towards DL.

### 2.2 Statistical Analysis

The questionnaire investigated 31 variables, four enquire about the characteristics of the sample, twenty are PSYCHO-COVID 19 items and seven are EMOTIONAL

**Table 1. Questionnaire's variables.**

Characteristics of the sample	PSYCHO-COVID 19 items	EMOTIONAL TERMOMETER applied to distance learnig
Age	Worries	Distress
Sex	Apathy	Anxiety
School Institute	Irritability	Depression
Level of exposure	Fear of people	Anger
	Fear of loneliness	Insomnia
	Gastric Disorder	Need for Help
	Difficult concentration	Joy
	Blurred vision, flushing, chills, weakness, itching	
	Musculoskeletal disorders	
	Sense of safety in the obligation to stay at home	
	Palpitation	
	Asthenia	
	Insomnia	
	Inner tension	
	Crying easily	
	Sweating, Vertigo, headache, frequent bowel movements	
	Weight in the chest	
	Sense of guilt	
	Decline of sexual desire	
	Hyphochondria	

TERMOMETER applied to Distance Learning (see Table 1).

Thus the number of distinct pairwise correlations is 465, corresponding to:  $n*(n-1)/2$ , being  $n = 31$  and taking into consideration both the symmetrical character of correlation and the trivial unit correlation of a variable with itself. Therefore, in order to get a manageable picture of the relation structure of the data set, we need a spectral approach to correlation structure able to highlight the most relevant fluxes of coordinated variation of the studied variables.

Principal Component Analysis (PCA), was used to reduce the dimensionality of data set by exploiting the between variables correlations. PCA was performed separately on the 'symptom' variables relating to the items of the PSYCHO-COVID 19 questionnaire (symptom PC) and on the variables related to feelings compared to distance learning (Distance Learning PC) detected through the EMOTIONAL TERMOMETER. The extracted components were then correlated to the explanatory variables (gender, age, School institution, level of exposure).

It is worth noting that the high number of respondents (148) makes even weak correlations to be statistically significant so confusing the global evaluation of the link between symptom and distance learning spaces that is the main aim of the work.

For this reason we limit our discussion to the most correlated component pairs ( $p < 0.001$ ).

Descriptive statistics were used to describe the sample.

### 3. Results

#### 3.1 Main Characteristics of the Sample

$N = 148$  from a total of 930 students from both participating institutions completed the questionnaire, 62% were female and 38% were male.

53% of the sample attended the Lyceum Piazza, 47% attended the Pandini Institute. Overall, about 16% of students completed the questionnaire, with a percentage slightly higher for the "Piazza" institution (17.5%) compared to the "Pandini" institution (14%).

The subjects were in the 14–21 age group, of which 38% of the sample was 18 years old. The average age of the students was 17 ( $SD = 1.7$ ).

About the level of exposure, almost 60% of the sample had no contagion containment measures applied to their person, except for those provided by the Government's restrictions extended to the whole nation. 27% of the students who answered the questionnaire had contagion containment measures applied to their person, but without symptoms. Only 0.68%, in addition to personal quarantine, had symptoms attributable to COVID-19 infection. No subject was hospitalized. Only 2% had a COVID 19-positive family member, while the percentage of hospitalization and deaths increased, when enlarging the family circle; 5% respectively had a hospitalized relative and 3% a relative that died (see Table 2).

#### 3.2 PSYCHO-COVID 19

The mean total PSYCHO-COVID 19 score was 18 points. Individual scores ranged from 0 points to 66 points

**Table 2. Characteristics of the sample.**

Sex	Number (n = 148)	%
Female	92	62
Male	56	38
School Institute		
Pandini	69	47
Piazza	79	53
Age		
21	2	1.35
20	8	5.41
19	29	19.59
18	57	38.51
17	12	8.11
16	16	10.81
15	14	9.46
14	10	6.76
Level of exposure		
No personal restriction	88	59.46
Quarantine without symptom	41	27.7
Quarantine with symptoms	1	0.68
Hospitalization of the subject	0	0
Covid 19-positive relative	3	2.03
Hospitalized relative	8	5.41
Loss of a relative	5	3.38
Loss of a friend	2	1.35

(the highest score in the group). The majority of subjects (65%) had a very low level of psychological discomfort and a state of adequate emotional management, 15% a low discomfort, 7% a moderate discomfort, while 12% presented a high psychological discomfort (Table 3).

**Table 3. Psychological discomfort level.**

Total score	% (n = 148)	Interpretation
0–21	65.54 (97)	Very Low
22–29	15.54 (23)	Low
30–36	6.67 (10)	Moderate
More than 37	12.16 (18)	High

PCA on symptoms suggests 5 relevant components (separated from the so called noise floor and thus being ‘bona fide’ signal) [35], with the first component (PCsymptom1) clearly predominant in terms of explained variance and representing the general extent of the effect indicating how all the ‘symptom’ variables go in the same direction along this component (Table 4). PCsymptom1 can therefore be immediately interpreted as an “distress entity” which then takes different forms depending on the subject. The first component expresses 40% of the general variability and includes worries, anger, fear of people, fear of loneliness, gastrointestinal symptoms, blurred vision/chills/flushing/weakness/itching, musculoskeletal disorders, palpitations, asthenia, insomnia, inner tension, easy

crying, sweating/dizziness/headache/frequent bowel movements, chest weight, guilt and hypochondria.

Correlations between the ‘symptom’ and ‘distance learning Principal Components and their statistical significance.

The second component (PCsymptom2) has no general psychological relevance as it records the singularity of the variable ‘sweating’ independent of the distress.

The third component (PCsymptom3), including apathy and decreased sexual desire, shows how these two symptoms go in the same direction. This would lead to the hypothesis that apathy could arise as a defense for the fact that not being able to go out I cannot see the partner and apathy flattens the desire, protecting me from frustration for not being able to do something I want.

Also noteworthy is the fourth component (PCsymptom4) which represents the sense of security from the obligation to stay at home which is independent of the extent of discomfort (i.e., the component that groups the highest number of symptoms) and also of symptoms grouped in other components.

The fifth component (PCsymptom5) has to do with the singular (and thus decoupled from the general psychological symptoms pattern) of Asthenia that is the only original variable with a relevant loading on this component.

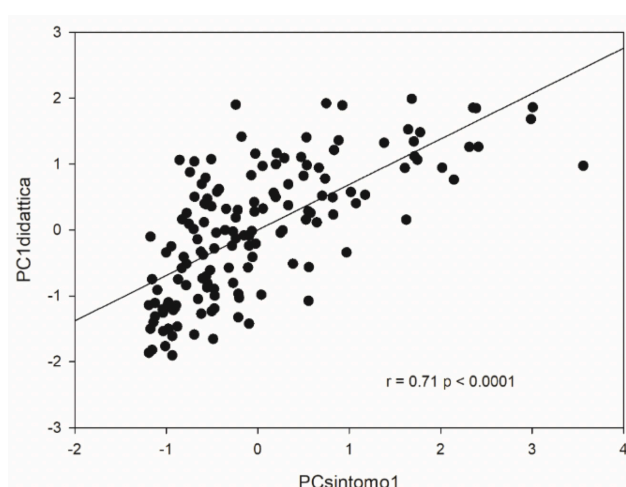
The distance learning analysis highlighted two components linked to the feelings towards distance learning. Only two relevant components emerge, the distance learning PC1 which collects only negative feelings towards distance learning (Distress, anxiety, depression, anger, insomnia, need help), and the distance learning PC2 which collects exclusively the joy of didactics. The two components are by construction independent, that is, one can be joyful even by suffering and vice versa. This reveals that despite a fairly negative view of DL, joy in students was not impacted by suffering from DL, otherwise joy would also have been in the Distance learning PC1. Joy in students was independent of having or not having a distance learning. This data is important and at the level of psychotherapeutic work it suggests that even in situations of distress, there are joyful parts that can be important resources.

Spearman’s correlation reveals that there is an almost linear correlation (see Fig. 1;  $p < 0.001$ ) between general distress (PCsymptom1) and negative feelings towards DL (PC1distance learning) which guarantees the congruity of the data and reveals that negative thoughts about DL arise from general distress, they are not peculiarities of the use of the teaching tool. Therefore, if an individual was not very symptomatic, he was more protected from the distress for distance learning.

When taking into consideration the relations between components and external variables we detected some quite interesting effects. The first is the gender effect: females show greater distress than males both in terms of symptoms and distance learning ( $p < 0.0001$ ). The second relevant

**Table 4. Principal components analysis.**

	pcsintomo1	pcsintomo2	pcsintomo3	pcsintomo4	pcsintomo5	pc1didattica	pc2didattica
pcsintomo1		-0.23478	0.05704	-0.07724	0.11889	0.70994	0.18283
$p <$		0.0041	0.4911	0.3508	0.1501	$<0.0001$	0.0261
pcsintomo2	-0.23478		0.03022	0.02547	0.07927	-0.20012	-0.04616
$p <$	0.0041		0.7154	0.7586	0.3382	0.0147	0.5774
pcsintomo3	0.05704	0.03022		-0.04675	0.08892	0.14770	-0.11789
$p <$	0.4911	0.7154		0.5726	0.2825	0.0732	0.1536
pcsintomo4	-0.07724	0.02547	-0.04675		0.06788	-0.04446	0.01521
$p <$	0.3508	0.7586	0.5726		0.4123	0.5915	0.8544
pcsintomo5	0.11889	0.07927	0.08892	0.06788		0.19591	-0.01725
$p <$	0.1501	0.3382	0.2825	0.4123		0.0170	0.8351
pc1didattica	0.70994	-0.20012	0.14770	-0.04446	0.19591		0.02642
$p <$	$<0.0001$	0.0147	0.0732	0.5915	0.0170		0.7500
pc2didattica	0.18283	-0.04616	-0.11789	0.01521	-0.01725	0.02642	
$p <$	0.0261	0.5774	0.1536	0.8544	0.8351	0.7500	

**Fig. 1. Correlation between PCsymptom1 and PC1distance learning.**

effect is the relation between the level of exposure and the distress for distance learning, as a matter of fact those who had a sick relative, or were themselves sick, suffered more for distance teaching ( $p < 0.05$ ).

#### 4. Discussion

This research aims to describe the psychological impact of the COVID 19 pandemic in adolescents. The questionnaires were completed starting from May the 5th, the date on which following the flattening of the contagion curve, the restrictive measures were relaxed and it was possible to attend one's "relatives", as well as leave the house to walk or play individual sports outdoors. The collection of protocols ended on June the 5th, two days after the end of the restriction that imposed travel only within one's own region.

Results show that the pandemic had a significant impact, with psychological discomfort in 35% of the sample examined, in accordance with the literature [36]. A discom-

fort factor that emerged is the female gender which has already been found in the literature [17–23]. The analysis of the main components revealed a "distress entity" with anxiety, depressive, somatic symptoms going to the same stressing condition direction and testifying the traumatic impact of the pandemic on the interviewed subjects. Wang [29] also emphasizes the role of somatic symptoms as an additional trigger to global inflammation due to COVID 19 virus, suggesting the need to treat somatic and depressive symptoms to reduce inflammation.

As for the use of ET as assessment tool, in a systematic review, it was considered as a valid and feasible distress screening test useful in situations of "Any significant emotion difficulty" [37]. ET has generated consistent findings and has proved to be an instrument with good criterion validity and reliability for the detection of emotional distress in cancer patients [38,39]. Its accuracy is comparable to HADS and BDI-II, and its implementation is highly encouraged [33,34,39].

The driving effect of the "distress entity" had a negative impact on the DL. Also this data is in agreement with the neuro-scientific literature according to which emotional difficulties negatively affect cognitive performance [40]. McEwen [41] argues that the long-term consequences of prolonged distress can have disastrous effects on cognitive functioning, including damage to the memory and hippocampal neuroplasticity as well as an increased risk of developing symptoms [41].

The analyzes also revealed a correlation between negative feelings about DL and the level of exposure; having symptoms or an infected friend/family member/relative contributed to experiencing DL negatively. The analysis of the collected data also reveals the presence of resources in students, such as the joy of learning despite the difficulties of the DL.

The DL was a leading theme during the debates about the effects of the pandemic on subjects in developmental age; the analysis of the data shows that the suffering for

DL was proportional to the distress perceived by students in general and not a factor in its own right. This distress, however, did not impact on the joy of living and learning.

The intensity and pervasiveness of the distress entity in response to the pandemic, combined with the consequent negative experience of the DL could hypothesize that the COVID 19 pandemic would be added to Adverse Childhood Experiences [20].

### Limitations

The online survey limits the quality of responses and assessment of daily habits, but this was the only way to collect data efficiently during the Pandemic. The sudden computerization of communication between school and students/families was not smart; each student was receiving an average of ten emails a day from the school. Thus, the informed consent and questionnaire link could easily go unnoticed. In addition, the online survey penalized both students who were not sufficiently familiar with fully computerized communications and underage students whose parents (not adept at online communications) did not give their consent to the survey.

These results emerged from a small sample of students belonging to the same area and attending two high schools, so this was a cross-sectional design that aimed to find correlations between the spread of the pandemic with its burden of sudden changes and the psychological health of these students. Although most of these limitations were due to the emergency circumstances, it was still necessary to undertake screening on the impact of these emergency situations and share the results with the scientific community.

## 5. Conclusions

Despite all of these limitations, the research project achieved its goal of conducting a screening of students' psychological status. Adherence was good, considering the emergency circumstances under which the questionnaire was administered. This research could be a snapshot of how adolescents coped with the pandemic and distance learning.

The statistical analysis showed a spread of distress. The symptoms that emerged could be comparable to those of a highly stressful condition. The data are congruent with the hypothesis that the pandemic affected the entire population in their mental health. Furthermore adolescents with their low emotion regulation and reactivity have an increased risk of developing many common forms of psychopathology, including generalized anxiety, eating disorders, depression, and social anxiety [42].

Research on adolescent psychiatric disorders in times of pandemic is needed because such a global situation could be prolonged or repeated [43].

Online learning on the other hand does not seem to have an impact on adolescents' mental health, while emotional difficulties and psychological symptoms do. This shows that adolescents can be resilient and adaptive when

needed, as long as they are equipped with the necessary tools and support [23].

These findings encouraged parents and teachers to assist adolescents in finding ways to maintain their social networks, monitor youth for signs of emotional distress, provide positive and supportive home and learning environments, and engage with mental health professionals early [23].

Our goal is that the research will give policymakers greater awareness of the plight of adolescents during the pandemic, in order to make balanced decisions, considering the social and emotional impact brought on by restrictive measures, especially school closures.

The results suggest designing a psychological care project for the following years in order to improve psychological support for students and psychoeducation for teachers and parents.

First of all, it is important to re-test students non-anonymously to identify individuals with chronic psychological distress and plan protective strategies, to reduce the sense of social isolation, which is a risk factor for suicide second cause of death among young people [44].

As in an article draw appropriate guidelines for psychological intervention following the epidemic directed to patients with COVID 19, their relatives but also to professional health care personnel, emphasizing the importance of psychological intervention performed by psychotherapists and psychiatrists trained on trauma, in order to curb the psychological consequences of forced quarantine or difficult work environments in an emergency situation [45].

Psychological interventions in high schools can be carried out both on individuals and classes, responding to the needs expressed by students through the survey.

It is also necessary to design cycles of meetings aimed at parents and teachers, in order to enhance the ability of adults to grasp the signs of distress and respond in a supportive and effective way. The meetings will also be open to politicians, psychologists and doctors from the community.

All meetings were performed on line by trained psychologist, in collaborations with doctors, through Google Meet School platform.

Improving the diagnosis and treatment of pandemic trauma is necessary to protect not only mental health [20, 21] but also global health [22].

## Author Contributions

CM, MP, IF designed the study. CM, recorded videos directed to students, parents and teachers in order to describe the purpose of the research, the tools used and how to fill in the questionnaire. MP and IF decided the tool (EMOTION THERMOMETER and PSYCHO-COVID 19). DV prepared the informed consent forms for adult students and parents of underage students, sent the questionnaire to the students who had joined the research

and collected the data through the platform used by the school. MP performed the statistical analyses. VT wrote the part relating to the description of the PSYCHO-COVID 19 questionnaire and the studies on the reliability and validity of the tool. CM, MP, EG, wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

## Ethics Approval and Consent to Participate

Every participant filled an informed consent (parents in case of underage students), after watching the videos in which the school psychologist explained the purpose of the research illustrating the tools and methods of compilation.

## Acknowledgment

We acknowledge the students who in such a dramatic moment agreed to take part in the research. We acknowledge EMDR National association, that creates a team that built the research design, identified the tools and carried out the data collection.

## Funding

This research received no external funding.

## Conflict of Interest

The authors declare no conflict of interest.

## References

- [1] Agorastos A, Tsamakis K, Solmi M, Correll CU, Bozikas VP. The need for holistic, longitudinal and comparable, real-time assessment of the emotional, behavioral and societal impact of the COVID-19 pandemic across nations. *Psychiatriki*. 2021; 32: 15–18.
- [2] Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, *et al*. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The Lancet*. 2020; 395: 912–920.
- [3] Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, *et al*. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *The Lancet Psychiatry*. 2020; 7: 547–560.
- [4] Golberstein E, Wen H, Miller BF. Coronavirus Disease 2019 (COVID-19) and Mental Health for Children and Adolescents. *JAMA Pediatrics*. 2020; 174: 819.
- [5] Douglas PK, Douglas DB, Harrigan DC, Douglas KM. Preparing for pandemic influenza and its aftermath: mental health issues considered. *International Journal of Emergency Mental Health*. 2009; 11: 137–144.
- [6] Kryszyska K, Lester D, Martin G. Suicidal Behavior after a Traumatic Event. *Journal of Trauma Nursing*. 2009; 16: 103–110.
- [7] Katz C, Fallon B. Protecting children from maltreatment during COVID-19. *Child Abuse & Neglect*. 2020; 110: 104753.
- [8] Qiu H, Wu J, Hong L, Luo Y, Song Q, Chen D. Clinical and epidemiological features of 36 children with coronavirus disease 2019 (COVID-19) in Zhejiang, China: an observational cohort study. *The Lancet Infectious Diseases*. 2020; 20: 689–696.
- [9] Hossain MM, Sultana A, Purohit N. Mental health outcomes of quarantine and isolation for infection prevention: A systematic umbrella review of the global evidence. *Epidemiol Health*. 2020; 42: e2020038.
- [10] Lamblin M, Murawski C, Whittle S, Fornito A. Social connectedness, mental health and the adolescent brain. *Neuroscience & Biobehavioral Reviews*. 2017; 80: 57–68.
- [11] Ellis WE, Dumas TM, Forbes LM. Physically isolated but socially connected: Psychological adjustment and stress among adolescents during the initial COVID-19 crisis. *Canadian Journal of Behavioural Science/Revue Canadienne des Sciences du Comportement*. 2020; 52: 177–187.
- [12] Brown BB, Larson J. Peer Relationships in Adolescence. In: Lerner RM, Steinberg L, (eds.) *Handbook of Adolescent Psychology* (pp. adlpsy002004). John Wiley & Sons, Inc.: Hoboken, New Jersey, USA. 2009.
- [13] Albert D, Chein J, Steinberg L. The Teenage Brain: Peer Influences on Adolescent Decision Making. *Current Directions in Psychological Science*. 2013; 22: 114–120.
- [14] Lewinsohn PM, Clarke GN, Seeley JR, Rohde P. Major Depression in Community Adolescents: Age at Onset, Episode Duration, and Time to Recurrence. *Journal of the American Academy of Child & Adolescent Psychiatry*. 1994; 33: 809–818.
- [15] Asmundson GJG, Taylor S. Coronaphobia: Fear and the 2019-nCoV outbreak. *Journal of Anxiety Disorders*. 2020; 70: 102196.
- [16] Li S, Wang Y, Xue J, Zhao N, Zhu T. The Impact of COVID-19 Epidemic Declaration on Psychological Consequences: A Study on Active Weibo Users. *IJERPH*. 2020; 17: 2032.
- [17] Helm SV, Pollitt A, Barnett MA, Curran MA, Craig ZR. Differentiating environmental concern in the context of psychological adaption to climate change. *Global Environmental Change*. 2018; 48: 158–167.
- [18] Mucci F, Diolaiuti F, Mucci N. Lockdown and isolation: psychological aspects of COVID-19 pandemic in the general population. *Clinical Neuropsychiatry*. 2020; 17: 63–64.
- [19] Wang G, Zhang Y, Zhao J, Zhang J, Jiang F. Mitigate the effects of home confinement on children during the COVID-19 outbreak. *The Lancet*. 2020; 395: 945–947.
- [20] Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, *et al*. Relationship of Childhood Abuse and Household Dysfunction to many of the Leading Causes of Death in Adults. *American Journal of Preventive Medicine*. 1998; 14: 245–258.
- [21] Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, *et al*. REPRINT of: Relationship of Childhood Abuse and Household Dysfunction to many of the Leading Causes of Death in Adults: the Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*. 2019; 56: 774–786.
- [22] Houtepen LC, Hardy R, Maddock J, Kuh D, Anderson EL, Relton CL, *et al*. Childhood adversity and DNA methylation in two population-based cohorts. *Translational Psychiatry*. 2018; 8: 266.
- [23] Magson NR, Freeman JYA, Rapee RM, Richardson CE, Oar EL, Fardouly J. Risk and Protective Factors for Prospective Changes in Adolescent Mental Health during the COVID-19 Pandemic. *Journal of Youth and Adolescence*. 2021; 50: 44–57.
- [24] Conti P. Induction of pro-inflammatory cytokines (IL-1 and IL-6) and lung inflammation by COVID-19: anti-inflammatory strategies. *Journal of Biological Regulators & Homeostatic Agents*. 2020; 34: 1.
- [25] Liu Y, Ho RC, Mak A. Interleukin (IL)-6, tumour necrosis factor alpha (TNF- $\alpha$ ) and soluble interleukin-2 receptors (sIL-2R) are elevated in patients with major depressive disorder: a meta-analysis and meta-regression. *Journal of Affective Disorders*. 2012; 139: 230–239.
- [26] Ng A, Tam WW, Zhang MW, Ho CS, Husain SF, McIntyre RS, *et al*. IL-1 $\beta$ , IL-6, TNF- $\alpha$  and CRP in Elderly Patients with De-

pression or Alzheimer's disease: Systematic Review and Meta-Analysis. *Scientific Reports*. 2018; 8: 12050.

- [27] Viljoen M, Panzer A. Proinflammatory Cytokines: a Common Denominator in Depression and Somatic Symptoms? *The Canadian Journal of Psychiatry*. 2005; 50: 128–128.
- [28] Hussong AM, Midgette AJ, Thomas TE, Coffman JL, Cho S. Coping and Mental Health in Early Adolescence during COVID-19. *Research on Child and Adolescent Psychopathology*. 2021; 49: 1113–1123.
- [29] Daniunaite I, Truskauskaite-Kuneviciene I, Thoresen S, Zelviene P, Kazlauskas E. Adolescents amid the COVID-19 pandemic: a prospective study of psychological functioning. *Child and Adolescent Psychiatry and Mental Health*. 2021; 15: 45.
- [30] Oliva S, Russo G, Gili R, Russo L, Di Mauro A, Spagnoli A, *et al.* Risks and Protective Factors Associated With Mental Health Symptoms During COVID-19 Home Confinement in Italian Children and Adolescents: The #Understandingkids Study. *Frontiers in Pediatrics*. 2021; 9: 664702.
- [31] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, *et al.* Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*. 2020; 395: 497–506.
- [32] Solomon R. Critical Incident Interventions. *Journal of EMDR Practice and Research*. 2008; 2: 160–165.
- [33] Mitchell AJ, Baker-Glenn EA, Granger L, Symonds P. Can the Distress Thermometer be improved by additional mood domains? Part i. Initial validation of the Emotion Thermometers tool. *Psycho-Oncology*. 2010; 19: 125–133.
- [34] Mitchell AJ, Baker-Glenn EA, Park B, Granger L, Symonds P. Can the Distress Thermometer be improved by additional mood domains? Part II. what is the optimal combination of Emotion Thermometers? *Psycho-Oncology*. 2010; 19: 134–140.
- [35] Broomhead DS, King GP. Extracting qualitative dynamics from experimental data. *Physica D: Nonlinear Phenomena*. 1986; 20: 217–236.
- [36] Wang C, Pan R, Wan X, Tan Y, Xu L, McIntyre RS, *et al.* A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain, Behavior, and Immunity*. 2020; 87: 40–48.
- [37] Harju E, Michel G, Roser K. A systematic review on the use of the emotion thermometer in individuals diagnosed with cancer. *Psycho-Oncology*. 2019; 28: 1803–1818.
- [38] Sanchez-Birkhead AC, Carbajal-Salisbury S, Larreta JA, Lovlien L, Hendricks H, Dingley C, *et al.* A Community-Based Approach to Assessing the Physical, Emotional, and Health Status of Hispanic Breast Cancer Survivors. *Hispanic Health Care International*. 2017; 15: 166–172.
- [39] Schubart JR, Mitchell AJ, Dietrich L, Gusani NJ. Accuracy of the Emotion Thermometers (ET) Screening Tool in Patients Undergoing Surgery for Upper Gastrointestinal Malignancies. *Journal of Psychosocial Oncology*. 2015; 33: 1–14.
- [40] Baker KS, Gibson SJ, Georgiou-Karistianis N, Giummarra MJ. Relationship between self-reported cognitive difficulties, objective neuropsychological test performance and psychological distress in chronic pain. *European Journal of Pain*. 2018; 22: 601–613.
- [41] McEwen BS. STRESS and HIPPOCAMPAL PLASTICITY. *Annual Review of Neuroscience*. 1999; 22: 105–122.
- [42] Rapee RM, Oar EL, Johnco CJ, Forbes MK, Fardouly J, Magson NR, *et al.* Adolescent development and risk for the onset of social-emotional disorders: a review and conceptual model. *Behaviour Research and Therapy*. 2019; 123: 103501.
- [43] Guessoum SB, Lachal J, Radjack R, Carretier E, Minassian S, Benoit L, *et al.* Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. *Psychiatry Research*. 2020; 291: 113264.
- [44] World Health Organization. Suicide in the world. Suicide in the world. 2019. Available at: <https://www.who.int/publications-detail/suicide-in-the-world> (Accessed: 1 October 2020).
- [45] Orrù G, Gemignani A, Conversano C. Psychological intervention measures during the COVID-19 pandemic. *Clinical Neuropsychiatry*. 2020; 17: 76–79.