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Original Research

COVID-19 protective behavior
When science interest and knowledge matter

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Abstract

Aim: This paper explores the different predictors of protective behavior of French secondary school students during the first COVID-19 pandemic. More specifically, a model of relationships has been drawn between the perceived knowledge, perceived severity, protective behavior, and interest in science.
Methods: A questionnaire including these four dimensions was used. We examine and confirm the factor structure, based on a sample of 691 high school students. Based on factor analyses and structural equation modelling, we have identified several major results predicting protective behavior.
Results: First, the protective behavior is composed of two clearly distinguishable dimensions that should be analyzed separately: preventive and avoidance behaviors. Second, and as expected, perceived severity, perceived knowledge, interest in science, and age of respondents can partly and unequally predict secondary school students' preventive and avoidance behaviors. However, having relatives infected with COVID-19 does not impact any dimension of the model.
Discussion: For future research, we suggest considering these behavioral subdimensions (preventive and avoidance), especially when considering school student samples. Our paper corroborates other studies advocating that developing science literacy and interest contribute to decision-making skills and protective behavior.
Conclusions: This study makes clearer the protective behavior components and predictors. We particularly emphasize the significance of incorporating scientific knowledge into educational programs to enhance students' understanding of and response to pandemics. Teachers should pay particular attention to late adolescent students regarding the importance of avoidance behavior.

Keywords: COVID-19, protective behavior, secondary school students, interest in science

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INTRODUCTION

The study presented in this article is set in the context of the start of the COVID-19 pandemic in France, during the first wave of infections. Like most countries in the world, in March 2020, the country entered a lockdown period with unprecedented challenges for schools and school children. As in some other countries, all schools were closed in mid-March, 2020, with a slow reopening after mid-May, 2020.

The context in France was marked with a very sudden change in government communication. The first message was reassuring, and based on the idea that the probability of the spread of the virus in France was low. However, with no warning, the communication suddenly became alarming. The government then rapidly decided to adopt a strong policy response, and the narrative for this new virus was related to a war context against a national enemy (1). The severity of the virus was demonstrated through daily data published in the media with the number of infected cases and deaths. Information about the virus circulated rapidly in media and social media. However, in French social media, it was noted that the information was more about the lockdown measures, and was disconnected from scientific information about the virus (2).

Many studies also highlighted the fact that during this period, mental health was strongly affected, in particular that of teenagers. At the start of the lockdown, it was highlighted that mental well-being was challenged by the emergence of a pandemic, and respondents demonstrating more cognitive rigidity also expressed more concern about the virus (3), with the population of high-school students being the most affected of all (4). However, in Italy, it was also shown that younger generations were less inclined to adopt protective behaviors (3).
In this context, scholars in biology education advocated the urgent need to promote biology and health literacy starting in childhood in order to address the challenges related to the COVID-19 pandemic (5). This question is not specific to the context of COVID-19, but also concerns other topics, such as climate change or the biodiversity crisis, where social perception and scientific information are linked, and where a growing mistrust in science is sometimes promoted (5).

Our study aims to identify the link mainly between the perceived knowledge and severity of the COVID-19 virus of teenage students (aged 15 to 18 years old) and their engagement with protective behaviors.

Background

Protective behaviors

Protective behavior can be categorized into three types: i) preventive behavior, broadly in the hygiene dimension (e.g., handwashing, wearing masks); ii) avoidance behavior referring to social distancing (e.g., stay at home, avoid crowded places); iii) management behavior, such as taking medication or monitoring heath (6). For instance, the study of Jørgensen, Bor (6), which was based on an extensive international sample (more than 20,000 individuals) highlighted that psychological factors (such as perceived worry, self-efficacy, etc.) correlated differentially to avoidance and preventive behavior. The typology is even more interesting as many studies broadly investigated protective behavior as a unique dimension, and failed to identify those three clear independent dimensions (7). For instance the study of Li, Yang (7), despite questionnaire items corresponding to the three types of protective behavior, identified a unique dimension called *precautionary behavior* without clear distinction between the three subdimensions.

Perceived severity

The perceived severity of COVID-19 has been designated by recent studies as a predictor for protective behavior. Based on an international adult sample (N = 953), Anaki and Sergay (8) showed that one third of the protective behavior variance is predicted by the severity of the disease and susceptibility to it, emotional reactions, and attitudes towards COVID-19. More specifically, the impact of perceived severity on avoidance behavior as staying at home has been reported (9). From the health promotion point of view, it is clear that the COVID pandemic has had a very high impact on population with many studies drawing links between perceived severity and anxiety (e.g., 10) and even depression (11).

Perceived knowledge

The role of perceived knowledge on protective behavior has been highlighted by many studies related to the COVID-19 outbreak (12). These studies are in line with many others that reveal links between low perceived knowledge and risk behavior, such as sexual risk behavior (13) and low hygiene practice related to disease transmission (14). However, in a recent study in Mexico, based on a 65 year-old and older sample (N= 417), Irigoyen-Camacho, Velazquez-Alva (9) found no clear link between avoidance behavior, such as staying at home, and knowledge about COVID-19. Nevertheless, a link between knowledge and COVID-19 vaccination (considered as a health-protective behavior) has been clearly drawn with a more extensive (N = 3,086) Australian sample (15).

Interest in science

Interest in science can be directly linked to science literacy (16), meaning that knowledge—or perceived knowledge about science—would be positively impacted by higher interest in science.

Empirically, Bathgate and Schunn (17) showed that for middle school students the intensity of the interest in science (more than a breadth of interest) may positively impact behaviors such as science engagement during science learning activities or science choice preference (in the case of optional activity choices). Moreover, many authors have highlighted the importance of the link between science literacy and decision-making skills (e.g., 18). Thus, interest in science may be linked directly or indirectly to decision-making related protective behavior.

Linkage with demographic variables

Prior research has shown connections between demographic variables and perceptions, or behavior related to the COVID-19 pandemic. For instance, Ding, Du (19) noticed that college students whose relatives had been exposed COVID-19 perceived a significantly higher risk than students who had not been exposed. Age is another important factor that previous studies took into account: The perceived severity of COVID-19 was positively associated to age (20). Along the same lines, Wolfe, Sirota (21) demonstrated that risk taking regarding the COVID-19 decreased within an older group compared to a younger group. Based on a metanalysis related to different pandemic situations, Bish and Michie (22) underlined that being older increases the chance of adopting protective behavior. Moreover, they revealed that females and more educated people were more associated with less risky behavior.

Rationale and research questions

Several studies have shown the importance of the dimensions of perceived severity, knowledge, and behaviors in exploring the perceptions of diseases, and more specifically of COVID-19. Surprisingly, those investigations have rarely drawn clear independent dimensions of protective behavior (such as preventive, avoidance, or management behaviors). Our work is based on the study of Li et al. (2020), who developed an instrument to assess the Chinese public's perception of the COVID-19 pandemic which included knowledge, perceived severity, and protective behavior as unique dimensions. Unlike Li et al.'s work, our paper specifically examines the possible independence of protective behavior subdimensions. In addition, our study tests the interest in science factor as a possible predictor of protective behavior.

Moreover, we have noticed that French university students have been intensively investigated (e.g.,23), while there is a lack of data concerning French secondary school students. Hence, this study aims to explore the following questions:

1 – To what extent the initial three-factor model (perceived knowledge, perceived severity, and protective behavior) fits when analyzing perceptions of COVID-19 by a sample of French secondary school students?

2 – What are the interrelations between perceived knowledge, perceived severity, protective behavior, and interest in science, including the impact of some demographic variables?

We tested the following hypotheses:
H1: The severity perception of COVID-19 would be positively predicted by perceived knowledge about COVID-19.
H2: Protective behaviors would be positively predicted by perceived knowledge about COVID-19.
H3: Protective behaviors would be positively predicted by perceived severity.
H4: Perceived knowledge would be positively predicted by interest in science.
H5 Protective behaviors would be positively predicted by interest in science.
H6: Demographic variables, such as age, infection by COVID-19, and knowing people who had and were infected with COVID-19 would predict the following endogenous variables: perceived knowledge, severity perception, interest in science, and protective behaviors.

METHODS AND PROCEDURES

Participants

The sample consisted of 691 secondary school students from the southern part of France. This sample corresponds to approximatively 1% of the of high school students in the Académie d'Aix-Marseille. In order to collect the data, secondary school teachers of the French language were contacted by the researchers through email, and were invited to apply the questionnaire to the students. We used Sphinx software to design the questionnaire, which had been filled in online during learning sessions between 19/05/2020 and 15/06/2020. At this time, France was locked down, but schools stayed open to admit primary and secondary school students. The average sample age was 16.5 years old and composed of 478 females and 213 males who came from 40 different French high schools (from the three levels that constitute the French high school). The sample was randomly split in two subsets: subset 1 with n=346 and subset 2 with n=345. Descriptive characteristics of each subset are summarized in Table 1. The objective of the creation of the two students' subsets was first to explore the structure and then confirm the factor structure.

Table 1: Characteristics of the subsets 1 and 2

Characteristics subset 1	N/Mean, (% or sd)
Gender	
Women	245 (71)
Men	101 (29)
Age	16.47 (1.11)
Being sick with COVID-19	
Yes	26 (8)
No	320 (92)
Knowing someone being sick with COVID-19	
Yes	125 (36)

No	221 (64)

Characteristics subset 2	N/Mean, (%/sd)
Gender	
Women	233 (68%)
Men	112 (32%)
Age	16.52 (1.25)
Being sick with covid	
Yes	29 (8%)
No	316 (92%)
Knowing relatives being sick with Covid	
Yes	137 (40%)
No	208 (60%)

Instruments

A part of the questionnaire is based on the work of Li, Yang (7), who developed a tool to assess the Chinese public's perception of the COVID-19 pandemic including knowledge, perceived severity, and protective behavior. In addition, their work explores other factors not addressed into our study. Furthermore, we investigated the students' interest in science as a complementary factor. The interest in science measurement is based on five items from the PISA questionnaire (24). All the answers were coded from 0 to 3 (from disagree to agree) except for some items (table 2) which have been reversed. The items have been translated and thereafter validated with back-translation. We included demographic items, such as age, gender, whether the participants believed they have been infected with COVID-19 (at this time COVID-19 testing was not easily accessible), whether they knew relatives who had been infected with COVID-19.

Table 2: Items used in the validated model

Items coding	**Items in French**	**Items translated in English**
Preventive behaviour		
Be2	Je porte un masque.	I wear a face mask.
Be3	Je change régulièrement de masque.	I change face mask regularly.
Be4	J'utilise le masque de manière appropriée (par exemple, je le retire sans toucher la zone avant, je le mets à la poubelle...).	I use the mask appropriately (e.g. I take it off without touching the front area, I put it in the bin...).

Be19	Je conseille aux gens qui m'entourent de suivre les gestes barrières donnés par le gouvernement.	I advise to people around me to follow the barrier measures given by the government.
Avoidance behaviour		
Be1*	Je me déplace.	I move around.
Be11*	Je vais dans des lieux publics.	I go to public places.
Be12	Je reste à la maison autant que possible.	I stay at home as much as possible.
Be13*	Je mange hors de mon domicile.	I eat outside my home.
Be14*	J'utilise les installations publiques (terrains de sport…).	I use public facilities (sports grounds...).
Be15*	J'utilise les transports en commun.	I use public transportation.
Perceived knowledge		
Kn1	Je connais bien les causes de la maladie.	I am familiar with the causes of the disease.
Kn2	Je connais bien les modes de transmission de la maladie.	I am familiar with the modes of transmission of the disease.
Kn3	Je connais bien la capacité du coronavirus à infecter une autre personne.	I am familiar with the ability of the coronavirus to infect another person.
Kn4	Je connais bien les symptômes de la maladie.	I am familiar with the symptoms of the disease.
Kn5	Je connais bien les critères de diagnostic de la maladie.	I am familiar with the diagnostic criteria for the disease.
Kn9	Je connais bien le taux de mortalité du Covid-19.	I am familiar with the mortality rate of Covid-19.
Perceived severity		
Se1	Je pense que le coronavirus se transmet facilement d'une personne à une autre.	I think that the coronavirus is easily transmitted from one person to another.
Se2	Je pense que les séquelles dues au coronavirus sont importantes.	I think the after-effects of the coronavirus are significant.
Se3	Je pense que le taux de mortalité dû au coronavirus est important.	I believe that the mortality rate due to the coronavirus is significant.

Se4	Je pense que l'impact d'une épidémie dû au coronavirus sur la société est important.	I think the impact of a coronavirus outbreak on society is significant.
Interest in Science		
Si1	Je trouve amusant d'apprendre les sciences.	I find it fun to learn about science.
Si2	J'aime lire sur des sujets de sciences.	I like reading about science topics.
Si3	Je suis content de travailler en sciences.	I enjoy working in science.
Si4	J'aime apprendre de nouvelles choses en sciences.	I like learning new things in science.
Si5	Je suis intéressé par apprendre des choses en sciences.	I am interested in learning about science.

* Reversed coded items

Procedure

In order to collect the data, secondary school teachers of the French language were contacted by the researchers through email, and were invited to apply the questionnaire to the students. We used Sphinx software to design the questionnaire, which had been filled in online during learning sessions between 19/05/2020 and 15/06/2020. At this time, France was locked down, but schools stayed open to admit primary and secondary school students.

Statistical analysis

The first split-half subset was used to investigate the construct validity of both instruments (perception of the COVID-19 pandemic and interest in science) by using a confirmatory factor model (CFA) (25). Since the CFA (with maximum likelihood estimation) indicated poor fit indices for the perception of the COVID-19 pandemic questionnaire, an EFA (exploratory factor analysis (26) was performed to investigate the model structure and dropped the irrelevant items. The second split-half subset was used to investigate the second research question. Thus, a CFA and structural equation modelling (SEM), based on the improved model obtained by the earlier EFA (first subset), was performed on this second split-half subset. The CFA aimed to confirm the factor structures previously observed with the first subset, and the SEM aimed to investigate the interrelations between the factors composing the model and the possible influence of extraneous variables (age, if students knew people infected, and if they had been infected by COVID-19).

Data management and analysis was performed by R software (V.4.1.0) using Lavaan and Psych packages (27).

RESULTS

Based on the first subset

Measuring COVID-19 perceived knowledge, severity perception, and protective behaviors

Based on the first split-half subset, a CFA was conducted by using the theoretical model proposed by Li, Yang (7): three dimensions (Knowledge with 10-Kn items, Perceived Severity with 5-Se items and protective behaviors with 19-Be items). The KMO test revealed a value of 0.76, while Bartlett's test was 4081.764 (df =561, $p<0.0001$). This indicated a good sampling adequacy and suitable structure detection for factor analyses, respectively. However, the fit indices indicate a poor model fit with our sample ($\chi 2/df = 4.2$, RMSEA = 0.099, SRMR = 0.122, CFI = 0.521). Thus, an EFA was applied to investigate the model structure and dropped the possible irrelevant items. The Kaiser's method was used to identify that four factors were retained for interpretation. We applied 0.45 as cutoff for item factor loadings (Table 3), and this was more than the 0.3 as a minimum suggested by Field (28). Therefore, 13 items of the initial questionnaire were dropped after failing to reach a minimum of 0.45. All the items related to management behaviors (e.g., Be17, closely monitor personal physical health) have been dropped from the model.

Table 3: EFA factor loadings, 0.45 as the retained factor loading cutoff

Items	Factor 1	Factor 2	Factor 3	Factor 4
Kn1			0,5134	
Kn2			0,5318	
Kn3			0,6978	
Kn4			0,6259	
Kn5			0,6320	
Kn9			0,5059	
Se1				0,5086
Se2				0,4534
Se3				0,5298
Se4				0,6550
Be1		0,6853		
Be5		0,6321		
Be11		0,6926		
Be12		0,5230		
Be13		0,4731		
Be14		0,5904		
Be15		0,5180		
Be2	0,8040			
Be3	0,8193			
Be4	0,7805			

Be19	0,5010

According to the EFA, two dimensions are related to the declarative knowledge and the perceived severity (respectively Factor 3 and Factor 4), as expected. Nevertheless, the third initial dimension related to protective behaviors is divided in two independent dimensions: Factor 1 and Factor 2, which are interpreted as related to avoidance behavior (Factor 2) and preventive behavior (Factor 1).

Measuring interest in science

The KMO test revealed a value of 0.88, while Bartlett's test was 4081.764 (df=561, p=0.000). It indicated a good sampling adequacy and suitable structure detection with CFA. Based on the interest in science items, the CFA indicated pretty good fit-indices ($\chi 2/df = 2.77$, RMSEA = 0.072, SRMR = 0.018, CFI = 0.992). The construct validity of the interest in science scale is good enough to be used directly with the second subset as a fifth factor. We have based the following analyses on this emergent five-factor model.

Based on the second subset

Descriptive statistics

The descriptive statistics are presented in Table 4. Based on the second subset results, the avoidance behavior (M = 2.59, sd = 0.65) was in general more respected than Preventive behavior (M = 2, sd = 0.96). Moreover, we noticed that for all the factors, the scores were above the mean of the scale (1.5).

Table 4: Descriptive statistics of each items composing the five retained factors

Factors	Mean (range :0-3)	sd
Preventive behaviour (Factor 1)	**2,00**	**0,96**
Be2	1,82	1,06
Be3	1,76	1,07
Be4	1,84	1,08
Be5	2,32	0,83
Be19	2,25	0,75
Avoidance behaviour (Factor 2)	**2,59**	**0,65**
Be1	2,16	0,90
Be11	2,57	0,70
B12	2,68	0,58
Be13	2,74	0,53
Be14	2,67	0,65
Be15	2,74	0,56
Knowledge (Factor 3)	**2,00**	**0,74**
Kn1	1,81	0,78
Kn2	2,36	0,63
Kn3	2,22	0,66
Kn4	2,20	0,68
Kn5	1,62	0,86
Kn9	1,79	0,84
Severity (Factor 4)	**2,35**	**0,68**
Se1	2,46	0,59
Se2	2,17	0,75
Se3	2,24	0,77
Se4	2,52	0,59
Science interest (Factor 5)	**1,96**	**0,81**
Si1	1,93	0,83
Si2	1,74	0,82
Si3	1,83	0,88
Si4	2,18	0,74
Si5	2,12	0,76

Confirmatory Factor Analysis

The KMO test revealed a value of 0.84, while Bartlett's test was 4181.159 (df =325, $p<0.0001$). This indicated a good sampling adequacy and suitable structure detection for factor analyses,

respectively.

As displayed in Figure 1A, the CFA verified the five-factor structure of the model: Preventive Behavior, Avoidance Behavior, Perceived Knowledge, Perceived Severity, and interest in science. All the items loaded very significantly on the respective factor (standardized factor loadings between 0.38 and 0.94). The fit indices showed an overall good model fit— model fit indices: $\chi 2/df = 1.84$, RMSEA = 0.049, SRMR = 0.059, CFI = 0.939.

Moreover, the analysis indicated acceptable-to-good internal consistency: preventive behavior (5 items, $\alpha = 0.86$), avoidance behavior (6 items, $\alpha = 0.61$), Knowledge (6 items, $\alpha = 0.78$), severity (4 items, $\alpha = .0.69$), interest in science (5 items, $\alpha = 0.91$).

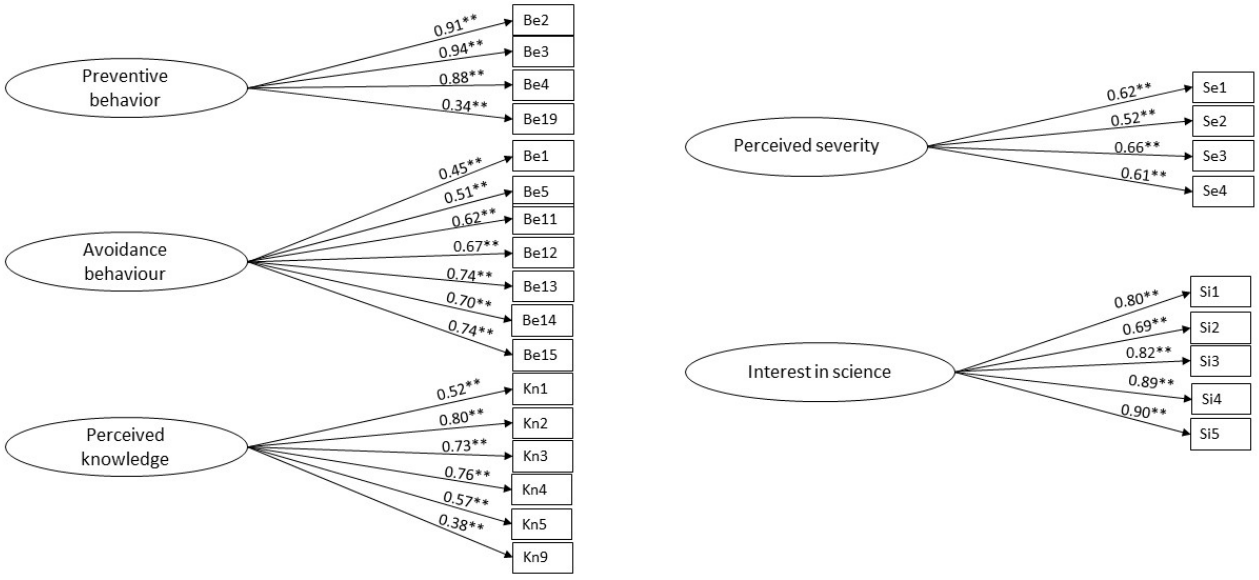

Figure 1: (A) Confirmatory Factor Analysis (CFA) of the 5 factors analysed with standardized factor loadings. Model fit indices: $\chi 2/df = 1.84$, RMSEA = 0.049, SRMR = 0.059, CFI = 0.939 (p-value < 0.05*; p-value < 0.01**).

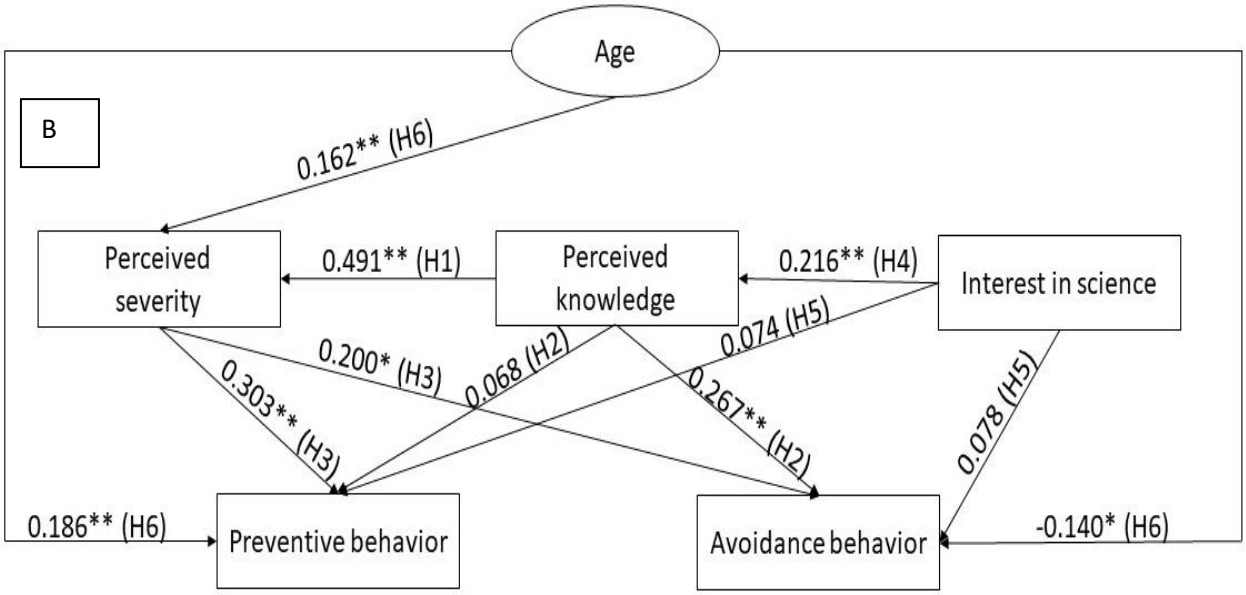

Figure 1: (B) Validated model with standardized path coefficients (p-value < 0.05*; p-value < 0.01**)

Structural equation model (SEM)

Within the scope of the study, we investigated the interrelation of the different factors and the impact of extraneous variables as predictors (age, if students knew people infected and if they had been infected by COVID-19). Thus, an SEM analysis was performed revealing that all of the fit statistics met the criteria for an acceptable model: $\chi 2/df = 1.789$, RMSEA = 0.048, SRMR = 0.057, CFI = 0.931 (figure 1B).

The result of the SEM clearly showed that perceived severity was positively predicted by perceived knowledge (H1 supported, 0.491, p<0.01). Perceived knowledge was positively predicted by interest in science (H4 supported, 0.216, p<0.01). However, interest in science failed to predict directly preventive and avoidance behavior (H5 not supported, respectively, 0.074, p = 0.18 and 0.078, p=0.18). Perceived knowledge positively predicted avoidance behavior (0.267, p<0.01), and failed to predict preventive behavior (0.068, p=0.35), therefore H2 is partially supported. Preventive behavior and avoidance behavior were positively predicted by perceived severity (H3 is supported, respectively 0.303, p<0.01 and 0.200, p<0.05).

In order to make Figure 1B easier to read, we have chosen to represent only the significant paths of the three exogenous variables (age, personally infected with COVID-19, knowing relatives infected with COVID-19). This means that perceived severity, perceived knowledge, interest in science, preventive behavior, and avoidance behavior were not predicted by knowing someone with COVID-19 or being infected with COVID-19. However, H6 is partially supported: Perceived

severity and preventive behavior were positively predicted by the age of the students (respectively, 0.162, $p<0.01$ and 0.186, $p<0.01$), and avoidance behavior was negatively predicted by age (-0.140, $p<0.05$).

DISCUSSION

This paper investigated some factors as predictors of high school students' protective behavior. Based on our sample, we saw that protective behaviors have to be analyzed as two independent sub-factors: preventive behavior *(e.g.*, Be2. *I wear a face mask*) and avoidance behavior (*e.g.*, Be11. *I visit a public place*), and the students tended to adopt both those types of protective behavior (scores are above the mean of the two dimensions' scores).

Protective behaviors, when knowledge matters

As expected, interest in science indirectly influences preventive and avoidance behavior through perceived knowledge and perceived severity, rather than directly. In other words, our results showed that interest in science may impact some aspects of the students' perception related to the COVID-19 pandemic. Our results are totally in line with (29) showing how interest in science and technology can impact their out-of-school activities. Perceived knowledge directly predicted avoidance behavior and perceived severity, confirming the work of Ding, Du (19) that showed the higher the knowledge level of college students, the higher their risk perception of COVID-19. Thus, as expected, students with a high perceived knowledge score tend to declare that they avoid social contact, and perceived COVID-19 as being more severe than students with less knowledge. The higher the perceived severity, the more they are likely to adopt protective behavior (preventive and avoidance). However, surprisingly, perceived knowledge does not directly predict the preventive behavior, rather than avoidance behavior. The low risk of complication due to COVID-19 among the targeted population may explain that teenagers pay less attention to preventive measures, unfortunately without taking into consideration that protective behavior starts with preventive measures. The clear independence between two types of protective behaviors with regard to COVID-19 has been rarely highlighted and only in research targeting adults' samples (6). Thus, we think that future research on a specific teenage population should take into account that protective behavior could be analyzed as two independent dimensions: preventive and avoidance behaviors. Nevertheless, a variety of symptoms, and the lack of treatment at this time, probably explains why management behavior dimensions did not arise from our analysis.

According to many other studies (e.g., 5, 30), the COVID-19 pandemic is a controversial socio-scientific issue. In such a disruptive change context (31), it is not so surprising that knowledge about COVID-19 is not a simple and direct predictor of protective behavior, but rather a component of a more complex model, as suggested by our findings. We strongly believe, as recommended by Byrne, Marston (30), that connecting scientific knowledge and social issues may help to develop students' critical thinking and impact their decision making skills, such as protective (preventive

and avoidance) behavior.

Exogenous variables impacting the model

Age positively predicts perceived severity and confirms previous studies (20). Moreover, the results show that the students close to adulthood seem to adopt better preventive behavior. Conversely, adoption behaviors in accordance with avoidance seem to be more difficult for the students at the end of the teenagerhood. That is not surprising, considering that late adolescents perceived friendship as being much more important than the early adolescents (32). Staying within the family unit and avoiding other social interaction are consequently easier for the youngest teenagers. Hence, we advise teacher-practitioners to pay attention to both dimensions with a specific focus on students in their late teens regarding the importance of avoidance behavior when facing a pandemic situation.

We expected an impact on the model of the variable *having relatives infected with COVID-19*. However, based on our results, no link has been highlighted. Contrary to the work of Cao, Fang (33), our findings failed to show that having a relative infected with COVID-19 may impact the perception of the COVID-19 pandemic. In the same way, no impacts of being infected with COVID-19 have been highlighted. The very small proportion of students infected in our sample and the low risk of complication in this population may explain, at least partly, this lack of effect.

CONCLUSIONS

First, the study confirms a structural model that includes perceived severity, perceived knowledge, interest in science, preventive behavior, and avoidance behavior as interconnected factors. Second, protective behaviors against COVID-19 are categorized into two independent sub-factors: preventive behavior and avoidance behavior. These behaviors are influenced differently by factors such as perceived severity and perceived knowledge. Third, perceived knowledge directly predicts avoidance behavior and perceived severity, indicating that individuals with higher knowledge levels tend to perceive COVID-19 as more severe and are more likely to adopt avoidance behaviors. However, perceived knowledge does not directly predict preventive behavior and age positively predicts perceived severity, with older students exhibiting better preventive behavior but struggling with avoidance behavior. Having relatives infected with COVID-19 or being infected oneself did not significantly impact perceptions or behaviors, likely due to the low prevalence of infection among the sample. Finally, we would like to highlight the importance of incorporating scientific knowledge into educational programs to enhance students' understanding of and response to pandemics. Teachers should pay particular attention to late adolescent students regarding the importance of avoidance behavior.

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