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Knowledge, attitudes and preventive behaviors toward COVID-19: a study among higher education students in Portugal

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Abstract

Purpose – The purpose of this study was to assess knowledge, attitudes and behaviors about COVID-19 among Portuguese higher education students.

Design/methodology/approach – In May 2020, all students from a Portuguese University were invited to participate in completing an online questionnaire. A total of 262 students participated. COVID-19 related knowledge, attitudes toward COVID-19 and preventive behaviors were assessed. Differences between outcomes and sociodemographics were analyzed through independent *t*-tests and the ANOVA. A generalized linear model was calculated to determine the predictive variables of preventive behaviors.

Findings – Students revealed good knowledge about COVID-19, correctly answering 13.06 (SD = 1.25) questions in a total of 14 and favorable attitudes toward preventive behaviors ($M = 32.73$, SD = 2.88). Students reported always engaging in, on average, 5.81 (SD = 2.61) of the 12 behavior analyzed. Females presented higher levels of knowledge, more positive attitudes and engaged in more preventive behaviors than males. Being a bachelor's (Exp (β) = 8.213, 95% CI: 1.791–37.670, $p < 0.01$) or a master's degree student (Exp (β) = 7.568, 95% CI: 1.598–35.835, $p < 0.05$) and having positive attitudes toward preventive behavior of COVID-19 predicted the adoption of those preventive behavior (Exp (β) = 1.340, 95% CI: 1.189–1.510, $p < 0.001$).

Originality/value – This study provides useful data to plan health education programs about COVID-19 among higher education students. The continuous investment by universities in preventive campaigns is essential to promote good preventive behaviors in the next academic year.

Keywords Coronavirus infections, Health knowledge, Risk reduction behavior, University students, COVID-19

Paper type Research paper

Introduction

The coronavirus disease 2019 (COVID-19) was declared a pandemic by the WHO on March 11th 2020 due to its high rate of infection which caused thousands of deaths worldwide and

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continues to expand [1]. The transmission route of COVID-19 is made directly between humans through droplets and respiratory secretions and indirectly through contact with contaminated surfaces and can also be transmitted by asymptomatic individuals. The main symptoms of the disease are essentially fever, dry cough and tiredness. Based on epidemiological investigations, the incubation period is 1–14 days. The elderly and chronically ill are at the highest risk of COVID-19 infection [2].

To control the pandemic, almost all countries have implemented public measures which included population behavior restrictions such as border closures, social isolation and school closures among other measures. Similar to other countries, the main individual protection measures adopted and recommended in Portugal and widely disseminated among the population were the use of a mask in indoor public places and public transportation; hand washing (with soap) and maintaining physical distance [3].

A community that is informed about the modes of transmission of the virus and how the exposure can occur, about the symptoms and the use of personal protective equipment among other topics is more prone to develop positive attitudes toward preventive measures, which, in most cases, is a predictor of the adherence to preventive health behaviors, thereby diminishing the spread of the virus. These assumptions are based on two of the most used models in health psychology: the health belief model [4], which assumes that the perceived susceptibility and severity of disease (risk perception), the perceived benefits and barriers related to prevention and treatment behaviors determine the health behaviors adopted and the theory of planned behavior [5], highlighting the importance of the attitudes toward the behavior to the formation of an intention to perform that action.

Emerging adulthood as a stage of life, in which higher education students are included, corresponds to a stage of learning and personality development, in the cognitive, physical, affective, sexual, family and social domains [6]. However, scientific evidence reveals a high prevalence of health risk behaviors among university students [7] which tend to persist throughout life and to have a considerable long-term impact on their health and well-being [8]. Moreover, university students should be regarded as emerging developmental agents, based on the belief that they have privileged knowledge due to their academic background and, consequently, own the power to influence a population's health. This can be exerted either through their individual choices, through hypothetical future occupations which imply responsibilities in building health policies or decision-making processes about them [9–11]. These emerging adults are, in this context, responsible for opening a range of preventive alternatives to society based on knowledge transmission and the adoption of protective attitudes toward potential infectious diseases.

The study aimed to identify the knowledge, attitudes and preventive behaviors of COVID-19 among higher education students in Portugal and to analyze the predictors of the adoption of those preventive behaviors.

Methods

Participants and procedure

This was a cross-sectional observational study. An online questionnaire was purposely developed and made available through Google Forms between 7th and 17th May 2020. All students enrolled in the academic year 2019/2020 at the University of Minho (Braga, Portugal), in any of the educational levels (bachelor's, master's or PhD) were eligible and were invited to participate in the study. The invitation was sent by e-mail to the institutional e-mails used by the students. At the University of Minho, all the enrolled students have access to their institutional e-mails, so they all received an invitation. In these e-mails, information about the objectives of the study as well as the ethical guarantee of confidentiality and anonymity in the data collected as stated in the informed consent were explained. Participation was completely

free and voluntary, and no personal data were collected from any participant. Of the 19632 enrolled students, a total of 262 higher education students participated in the study (response rate: 0.013%).

Instruments

The questionnaire was developed based on a literature review including (1) information provided by and guidelines from the Health Authorities (Portuguese General Health Directorate and World Health Organisation) regarding COVID-19 and (2) studies already performed on the same topic in other countries where several common items were used to assess each of the dimensions analyzed in this study. The proposed items were then grouped, and redundant items were removed.

A preliminary version of the instrument was reviewed by two researchers in the fields of health and science education to validate its content. A pre-test was then performed with a small sample of higher education students to test for comprehension and difficulty. All the questions remained without modifications. The psychometric characteristics of the questionnaire were tested, as described in the statistical analysis subsection.

The final version of the questionnaire contained 43 questions; four about sociodemographic data (sex, educational level, scientific area and professional status) and 39 items divided into three sections (Appendix 1).

COVID-19-related knowledge: this scale consisted of 14 statements related to the symptoms of COVID-19, the modes of transmission, the use of personal protective equipment, hand washing, disinfection and exposure to the virus. The participants were asked to respond if they considered those statements as "True", "False" or "I don't know". One point was assigned to each correct answer, while providing an incorrect answer or responding "I don't know" received 0 points. The sum of all items was made hence higher scores corresponded to a higher level of knowledge. Cronbach's alpha for the scale calculated with the sample of this study was acceptable ($\alpha = 0.663$).

Attitudes toward COVID-19: this scale was composed of 12 items, and the response categories consisted of a five-point Likert scale (from 1–strongly disagree to 5–agree), with the highest score corresponding to more positive attitudes toward preventive behaviors. Some items on the scale were inverted for the analysis. The exploratory factor analysis extracted two factors for this scale which were designated according to their content as "Attitudes toward preventive behaviors" and "Attitudes toward risk perception" and explained 51.46% of the total variability. The coefficient of internal consistency for each factor was acceptable ($\alpha = 0.725$ and $\alpha = 0.509$, respectively). A sum of all the items within each factor was made to obtain a score. The "Attitudes toward preventive behaviors" factor consisted of seven items and varied from 7 to 35, with the highest score corresponding to more positive attitudes toward preventive behaviors. The "Attitudes toward risk perception" factor included five items in a range between 5 and 25 and the higher values corresponded to a greater perception of risk.

Preventive behavior: this scale referred to the number of preventive behaviors adopted and included 13 items (personal protective equipment, physical distance, hand washing, disinfection and exposure to COVID-19). The data analysis reports to 12 items because the two items related to the use of a mask were grouped (use of either a surgical mask or a community mask). Each item was answered using a five-point scale (From 1–Never to 5–Always), with one point assigned to each behavior that was always practiced. The number of behaviors practiced was added up. A high score on this scale indicated good preventive behaviors, ranging from 0 to 12. The internal consistency of the scale was $\alpha = 0.711$.

Statistical analysis

The analysis was performed using IBM Statistical Package for the Social Sciences *Statistics for Windows*, version 26.0, Armonk, NY, USA. In order to analyze the psychometric

characteristics of the scales, an exploratory factor analysis, using principal component analysis with varimax rotation, was carried out. An item was disregarded if the factor loading was lower than 0.4. Afterward, reliability was analyzed through the calculation of item-total correlation coefficients and Cronbach's alpha (α) for the scales of the questionnaire. The descriptive analyses were presented in absolute (n) and relative (%) frequencies, mean (M) and standard deviations (SD). To assess the differences between the outcome variables (knowledge, attitudes and behaviors toward COVID-19) and the sociodemographic characteristics, considering the sample size, independent t-tests and the ANOVA were used, as appropriate. The correlations between the outcomes of the study were calculated by Pearson's correlation. Lastly, a generalized linear model was calculated to determine the predictive variables of the preventive behaviors. Exp (β) and the respective 95% confidence intervals (95% CI) were presented. Statistical significance was defined as $p < 0.05$.

Ethical considerations

This study was approved by the Ethics Committee for Research in Social and Human Sciences (CEICSH) of the University of Minho Ethics Council, under the protocol CEICSH 009/2019.

Results

This study comprised a total of 262 higher education students. The sociodemographic characteristics of the sample are presented in Table 1. Most higher education students were female ($n = 206$, 78.4%) and full-time students ($n = 195$, 76.8%). 158 students were registered for a bachelor's degree course (60.3%), 94 students were in master's degree programs (35.9%) and 10 respondents were Ph.D. students (3.8%). The highest number of students were studying human and social sciences ($n = 124$, 47.5%), followed by engineering sciences ($n = 57$, 21.8%) and law and economic sciences ($n = 57$, 21.8%).

Students revealed a good level of knowledge about COVID-19, correctly answering a mean of 13.06 ($SD = 1.25$) questions in a total of 14. The item "Loss of smell is a symptom of COVID-19" had the lowest proportion of correct responses (59.9%). There were differences in the level of knowledge according to the sex of the students: female students showed a higher level of knowledge compared to male students ($M = 13.15$, $SD = 0.98$ vs $M = 12.75$, $SD = 1.91$, respectively; $t\ (252) = -2{,}121$, $p < 0.05$) (Table 1).

Concerning attitudes toward COVID-19, students showed in general highly favorable attitudes toward preventive behavior ($M = 32.73$, $SD = 2.88$), these being higher among females ($M = 33.04$, $SD = 2.19$) than males ($M = 31.55$, $SD = 4.43$) ($t\ (252) = -3.507$, $p < 0.001$). The perception of risk among university students was moderate ($M = 16.82$, $SD = 2.97$), differing by sex: females showed a higher perception of risk than males ($M = 17.10$, $SD = 2.74$ vs $M = 15.79$, $SD = 3.56$, respectively; $t\ (252) = -2.981$, $p < 0.01$) (Table 1).

Regarding behaviors, considering the 12 preventive behavior studied, students reported always engaging in, on average, 5.81 ($SD = 2.61$) of these behavior. An analysis by sex showed that females more frequently engaged in preventive behavior than males ($M = 6.01$, $SD = 2.59$ vs $M = 5.09$, $SD = 2.60$, $t\ (260) = -2.358$, $p < 0.05$). In addition, Ph.D. students exhibited a lower number of preventive behavior ($M = 3.70$, $SD = 2.71$) compared to master's students ($M = 5.93$, $SD = 2.32$) and bachelor's students ($M = 5.88$, $SD = 2.73$) ($Z\ (2.259) = 3.473$, $p < 0.05$).

The analysis of the correlations between the outcomes of the study – knowledge, attitudes and behaviors – revealed the existence of positive and statistically significant correlations between the preventive behaviors and knowledge related to COVID-19 ($r = 0.241$, $p < 0.01$),

Table 1.
Differences in outcomes according to the sociodemographic characteristics of participants ($N = 262$)

Sociodemographic characteristics	n (%)	COVID-19 related knowledge (Range 0–14) M (SD)	t/F value	Attitudes toward preventive behaviors (Range 7–35) M (SD)	t/F value	Attitudes toward risk perception (Range 5–25) M (SD)	t/F value	Preventive behavior (Range 0–12) M (SD)	T/F value
Sex									
Male	56 (21.37)	12.75 (1.91)	−2.121*	31.55 (4.43)	−3.507***	15.79 (3.56)	−2.981**	5.09 (2.60)	−2.358*
Female	206 (78.63)	13.15 (0.98)		33.04 (2.19)		17.10 (2.74)		6.01 (2.59)	
Educational level									
Bachelor	158 (60.31)	12.97 (1.42)	1.297	32.61 (3.27)	0.956	16.74 (2.99)	0.145	5.88 (2.73)	3.473*
Master	94 (35.88)	13.16 (.92)		33.00 (2.09)		16.95 (3.06)		5.93 (2.32)	
Ph.D	10 (3.82)	13.50 (.71)		31.90 (2.73)		16.90 (1.97)		3.70 (2.71)	
Scientific area									
Engineering sciences	57 (21.84)	13.05 (0.93)	1.414	32.67 (2.38)	0.383	16.63 (3.25)	1.885	5.26 (2.57)	1.086
Exact and natural sciences	14 (5.36)	13.43 (0.65)		32.93 (1.33)		16.14 (2.32)		6.36 (1.82)	
Law and economic sciences	57 (21.84)	13.00 (1.00)		32.44 (2.63)		17.65 (2.50)		5.81 (2.54)	
Health sciences	9 (3.45)	13.89 (0.33)		33.44 (2.19)		15.44 (4.98)		6.56 (2.19)	
Human and social sciences	124 (47.51)	13.00 (1.52)		32.87 (3.29)		16.72 (2.89)		5.98 (2.75)	
Professional situation									
Full time student	195 (76.77)	13.05 (1.31)	−0.206	32.66 (2.83)	−0.802	16.82 (2.85)	0.209	5.85 (2.51)	0.564
Worker/student	59 (23.23)	13.08 (1.09)		33.00 (3.07)		16.73 (3.26)		5.63 (2.94)	
Total	262 (100.00)	13.06 (1.25)		32.73 (2.88)		16.82 (2.97)		5.81 (2.61)	

Note(s): *M*, mean; *SD*, standard deviation; *Z*, ANOVA test value
***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

the attitudes toward preventive behaviors ($r = 0.389$, $p < 0.01$) and the risk perception ($r = 0.130$, $p < 0.05$). These two last variables were also intercorrelated (Table 2).

Results from the generalized linear model indicated that the educational level and the attitudes toward preventive behaviors had a statistically significant effect on the preventive behaviors adopted. Thus, being a bachelor's (Exp (β) = 8.213, 95% CI: 1.791–37.670, $p < 0.01$) or a master's student (Exp (β) = 7.568, 95% CI: 1.598–35.835, $p < 0.05$) and having positive attitudes toward preventive behavior of COVID-19 predicted the adoption of those preventive behavior (Exp (β) = 1.340, 95% CI: 1.189–1.510, $p < 0.001$) (Table 3).

Discussion

The results regarding the COVID-19-related knowledge revealed a good understanding of the symptoms of COVID-19 as well as its preventive measures and recommendations. Previous studies among higher education students revealed good knowledge about this pathology [12–15]. However, whilst previous studies were mainly pertaining to medical students, our sample mostly comprised students in the human and social science fields. Thus, although we could expect lower levels of knowledge among students of non-health-related fields, this was not verified in our results. For example, the study by Alzoubi and colleagues [12] showed the inexistence of differences in COVID-19 knowledge between medical and non-medical colleges. Other research with students from diverse scientific areas revealed only average levels of knowledge about coronavirus infections [16, 17].

Although we have not collected data about the sources of information used by the students, based on the above we can hypothesize that knowledge about COVID-19 may

Variables	Preventive behavior	COVID-19-related knowledge	Attitudes toward preventive behaviors	Attitudes toward risk perception
Preventive behavior	1			
COVID-19-related knowledge	0.241**	1		
Attitudes toward Preventive behavior	0.389**	0.503**	1	
Risk perception	0.130*	0.180**	0.270**	1

Note(s): **$p < 0.01$; *$p < 0.05$

Table 2. Pearson's correlation coefficient between the study outcomes

		β	SE	χ^2 wald	df	p	Exp (β)	95% CI	
Intercept		−8.064	2.0844	14.969	1	0.000	0.000	5.291E-6	0.019
Sex	Male	−0.449	0.3688	1.479	1	0.224	0.639	0.310	1.316
	Female	0[a]							
Educational level	Bachelor	2.106	0.7771	7.342	1	0.007	8.213	1.791	37.670
	Master	2.024	.7934	6.507	1	0.011	7.568	1.598	35.835
	Ph.D	0[a]							
COVID-19-related knowledge		0.165	0.1369	1.444	1	0.230	1.179	0.901	1.542
Attitudes toward Preventive behavior		0.293	0.0611	22.904	1	0.000	1.340	1.189	1.510
Risk perception		0.015	0.0515	0.086	1	0.770	1.015	0.918	1.123

Note(s): [a]Reference category

OR: odds ratio; 95% CI: 95% confidence intervals; AIC = 1209.358; χ^2 (6) = 52.434, $p < 0.001$

Table 3. Generalized linear model predicting preventive behaviors of COVID-19

have been acquired outside the academic context. Previous studies [12, 18] showed that the commonest sources of information about COVID-19 for university students are the media [14, 18, 19] and social networks. These sources were followed by the WHO, TV, the Internet, the Ministry of Health and friends [12, 18]. This aspect shows the importance of the internet in conducting health education campaigns aimed at higher education students [14, 20], namely the websites from the different national [3] and international health authorities [2, 21]. Official announcements released by governments [18] were also among the main sources of information for university students. The study carried out by Yang and colleagues [18] showed that 95% of the students surveyed obtained information about COVID-19 in government press releases and revealed confidence in that information.

This study also showed that students have positive attitudes regarding how people should behave toward COVID-19, similar to other international studies [12, 14–16] and reflected the correct way to prevent infection by COVID-19, such as careful hand washing and disinfecting surfaces and objects. Assad and colleagues [14] identified a high prevalence of university students who said they were afraid of the possibility of a family member contracting MERS-CoV (Middle East Respiratory Syndrome), a viral respiratory disease also caused by a coronavirus. In the present study, the fear of having a family member infected by the virus, which was evaluated through the attitudes toward risk perception, was moderate, as observed in other studies [13].

Contrary to international scientific evidence [12, 13, 18], it is not possible to affirm that higher education students have good preventive behaviors against COVID-19 since there were behaviors – such as the need for social distancing or disinfection of footwear and purchased products – that were not highly prevalent.

Bivariate analyses revealed sex differences regarding the main variables with females' scores systematically higher than males' scores. This is aligned with the "men's health-gap" revealing that globally, health outcomes are substantially worse among men than women [22]. Due to social constructions of masculinity, males are more unwilling and lack the motivation to search for health-related information [23], moreover, traditional masculinity is associated with risky behaviors and less utilization of preventive health care [24].

In addition, one of the most important results of this study refers to the positive and significant correlation between preventive behavior and the perception of risk. As previously shown in other health-related behaviors such as smoking, perceiving them as risky is related to a reduced intent to adopt unhealthy behaviors [25]. In this case, as risk perception increases, preventive behaviors also increase. In the study by Yang and colleagues [18], the increase in risk perception led most students to adopt greater compliance with preventive practices. This suggests that the students who most fear the virus will protect themselves the most. This result contrasts with the results of the study by Chen and colleagues [26], in which the two variables were negatively correlated. Also in line with the theories of health behavior studied by Ajzen [5], this study showed that having positive attitudes toward preventive behaviors predicted the adoption of those preventive behaviors which highlight the relevance of including these dimensions in awareness campaigns aimed at promoting attitudes to increase healthy behaviors. The fact that bachelor's and master's students were more prone to engage in preventive behaviors than Ph.D. students, who constituted a small part of our sample (n = 10; 3.82%), can be considered a surprising outcome, taking into account we expect the same or a higher level of information among these students, and thus higher levels of adoption of the recommended behaviors. This result would benefit from a qualitative study to complement this quantitative work and would help to capture and understand how people make meaning and sense of this health dimension [27].

Limitation

First, the data collected with the use of an online platform can result in some bias, particularly in the knowledge scale since there is no guarantee that students have not searched for answers in any resource. Being aware of this possibility, this was the best way to develop this study due to the confinement restrictions experienced. Moreover, by making it possible for students to have sought answers to questions of knowledge, the social impact of this study may have been worthwhile, considering that, according to the results obtained, knowledge about COVID-19 correlates positively with preventive behaviors. In addition, the preventive behaviors were self-reported so may not reflect exactly how the students behave. Lastly, this study was carried out at a single university. Although the University of Minho welcomes students from diverse regions of the country as well as foreign students from various countries, and its academic courses offer a wide range of scientific fields, the fact that only a small proportion participated in the study implies that the generalizability of data to other Portuguese university students should be made with caution. However, we may hypothesize that the wide exposure to national and international media coverage of this topic contributed to similar levels of knowledge among students from different universities.

Conclusions

This study revealed a good knowledge level about COVID-19 among higher education students in Portugal and indicated positive attitudes toward preventive behaviors, moderate risk perception and a moderate adoption of preventive behaviors. Moreover, it reinforces that a high-risk perception is associated with practicing preventive behaviors and that having positive attitudes toward preventive behaviors is a main determinant of these behaviors. Thus, this study can provide policymakers with relevant cues to help plan health education programs at universities, promoting preventive behaviors and reducing the spread of the virus. As supported by Bokadia and Ganapathy [16], health education programs about the coronavirus should be promoted to reinforce knowledge and attitudes that will positively influence the behaviors adopted. The provision of reliable information by the institutions with consideration for the specific target audiences [28] is essential to increase individuals' confidence. Finally, investment in the creation of a health-promoting environments in universities which promotes citizens' trust regarding the safety of using public spaces, by offering, for example, disinfectant gel, regulating the use of masks and organizing the spaces to guarantee the required physical distancing [3] is fundamental to promote behavior adherence.

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(The Appendix follows overleaf)

Appendix 1
Questionnaire items about COVID-19 related knowledge, attitudes toward COVID-19 and preventive behavior

COVID-19 Related Knowledge

1. Sneezing or coughing into the forearm helps to reduce exposure and transmission of COVID-19. - T
2. The use of a face mask does not help prevent COVID. – F
3. Maintaining a safety distance of at least 2 meters is essential to avoid infection with COVID-19. - T
4. Measures to prevent the spread of the disease include frequent hand washing. – T
5. COVID-19 can be transmitted through contact with contaminated surfaces and objects. - T
6. The people most at risk of serious COVID-19 disease are the elderly and people with chronic illnesses. - T
7. Young people are not at risk of being infected with the COVID-19 virus. - F
8. COVID-19 is the same as the seasonal flu. - F
9. Loss of smell is a symptom of COVID-19. - T
10. It is possible to be infected with COVID-19 and not have any symptoms. - T
11. All confirmed cases of COVID-19 require hospitalization. - F
12. Cough, fever, or shortness of breath are the main symptoms of COVID-19. - T
13. COVID-19 is only transmitted by close contact with infected people. - F
14. It is possible to contract COVID-19 by contact with contaminated objects. - T

Attitudes towards COVID-19

Attitudes towards preventive behaviors

1. The use of personal protective equipment should be a personal decision.
2. The use of protective equipment helps to prevent infection.
3. The use of a mask should be mandatory in all closed public places, for example, in supermarkets.
4. Careful handwashing is important to prevent contagion by COVID-19.
5. It is important to wash/disinfect surfaces and objects that may be contaminated.
6. The permanence in public spaces should be more restricted.
7. It is acceptable to have symptoms of COVID-19 and to walk on the street.

Attitudes towards risk perception

1. I have confidence in the Health Authorities.
2. I feel safe because I use appropriate protective measures.
3. I feel insecure if I have to go to university.
4. I am afraid of contracting COVID-19.
5. I am afraid that a family member or friend will contract COVID-19.

Preventive Behaviours

1. I wear a protective surgical mask indoors.
2. I wear a community protective mask ("homemade") in indoor public places.
3. I put on a face mask as soon as I leave the house.
4. I wear disposable gloves indoors.
5. I wear a visor in indoor public places.
6. When I am talking to someone, I maintain a safe distance.
7. When I am walking or doing sports outdoors, I maintain a safe distance.
8. I avoid social interactions that requires physical proximity.
9. I wash my hands according to the guidelines of the General Directorate of Health.
10. I use alcohol or hand sanitizer.
11. I disinfect and/or change my shoes when I get home.
12. I disinfect the products I buy.
13. I disinfect objects such as door handles, taps, or handrails in my home.

Note(s): T – True; F - False

Table A1. Questionnaire items about COVID-19 Related Knowledge, Attitudes towards COVID-19, and Preventive Behaviours

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