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# Investigating the role of non-pharmaceutical interventions (NPI) during pandemics: COVID-19 as an example

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## Abstract

**Background and objective** The coronavirus pandemic, with a wide range of clinical manifestations, is considered a serious emergency in increasing anxiety for vulnerable groups of young people such as students. The purpose of this study is to look into how COVID-19 affects depression and anxiety in students at Damghan University. It also aims to determine how non-pharmaceutical intervention (NPI) education affects COVID-19 anxiety and related aspects.

**Methods** This is a descriptive-analytical cross-sectional study conducted on 276 students from Northeast Iran in 2022 using the convenience sampling method. The data were collected by posting the standard electronic questionnaire of the Coronavirus Anxiety Scale (CAS) on the study site's popular social media platforms. Participants were also given online access to the data collection (NPI) training protocols. Data were analyzed using SPSS-22 statistical software and descriptive and inferential statistical tests.

**Results** 42.3% of participants in the study did not use or used very little of the Infection Prevention and Control (NPI) education, and considering participants' concerns about contracting COVID-19, 7.97% were somewhat concerned, while 58.3% were considered highly concerned. This result indicates that not using (NPI) education leads to increased anxiety. Most participants reported being highly compliant with using NPI trainings and COVID-19 prevention guidelines (57.6%), and 68.4% believed that COVID-19 will soon be eradicated. This result shows that (NPI) education lead to increased hope and decreased anxiety.

**Conclusion** In the near future, these findings may be helpful in the creation and execution of preventative initiatives and coping mechanisms.

**Keywords** COVID-19, Anxiety, Depression, Perceived social support, (NPI) education

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## Introduction

Like any other chronic illness, COVID-19 causes oxidative stress and inflammation, which, over time, can harm every cell in the body. Different degrees of DNA damage can be caused by free radicals, which can result in genomic instability and ultimately produce malignant cells. The unexpected spread of the coronavirus illness in 2019 (COVID-19), which leaves little time for preparedness for defense, is one of the primary causes of the disease's major social impact [1–3]. In order to produce illness-related consequences, COVID-19 has emerged as a complex, multisystemic, and multi-organ condition with a completely ubiquitous target at several organ levels. A wide family of viruses known as coronaviruses, which cause illnesses ranging from the common cold to more severe conditions like severe acute respiratory syndrome (SARS), is worth mentioning. All age groups are susceptible to the virus, and elderly patients with underlying conditions are more likely to experience severe illness [3, 4]. COVID-19 is spreading too quickly, as evidenced by imported cases in travelers, cases of "no-mask" transmission, and cases involving close interactions between two or more known infected individuals. The scarcity of ventilators and personal protective equipment (PPE) has been putting a strain on healthcare management systems [4, 5]. COVID-19 is a modern and mysterious mutation that has posed a challenge to humanity. Although early cases of COVID-19 were connected to the seafood market in Huanan, South China, the source of the virus is still unknown [6]. Even with multiple COVID-19 vaccinations available, the disease is still quite common and keeps spreading, weakening, and getting stronger. Furthermore, the appearance of novel coronavirus mutations puts public health protocols in jeopardy and compels policymakers to act decisively going forward. Because of this, worries regarding mental health are becoming more common, and they are accompanied by COVID-19-related quarantine restrictions as well as financial difficulties brought on by other social and employment constraints. There is proof that people suffer from mental health issues when the epidemic is spreading. Disruptions to university students' study patterns might cause them to fall behind in their coursework and become less competitive in the job market, which makes them anxious. Their mental health was also severely strained by the rise in media coverage and the number of new cases. Adverse outcomes could result in negative actions like substance misuse and suicide. Furthermore, the psychological impacts of this pandemic on university students in China, Israel, Spain, and the general population of various other countries have been documented in recent research [7, 8]. By lowering the burden of sickness and reducing the number of major infectious diseases, education and the use of different preventive and control methods finally result in a considerable reduction in infectious diseases. The use of masks, physical separation, school closures, travel restrictions, and other pandemic mitigation measures significantly lowers the spread of some of the most serious respiratory viruses, including the respiratory syncytial virus (RSV) and influenza [9, 10]. During the COVID-19 pandemic, the aim of education and nearly simultaneous global measures (NPIs) is to decrease the rate at which SARS-CoV-2 is spreading within the community, lessen the illness burden, and lower the demand for medical resources. This will control the amount of time needed to produce vaccines and treatments. Since 2019, there have been numerous ramifications for people, communities, and governments as a result of the COVID-19 pandemic, NPI implementation, and education. Because the goal of NPIs is to lessen the spread of respiratory viruses, there have been notable alterations to the typical seasonal circulation patterns, leading to frequent respiratory viral diseases, including RSV and influenza [9, 10]. One successful method for preventing and controlling COVID-19 transmission in the community is the use of non-pharmaceutical therapies. Nevertheless, different nations and areas have adopted these policies at different times and with different degrees of strictness. The frequency of diseases and the current immunization regimens can only partially account for the variations in stringency. Non-pharmaceutical interventions (NPIs) have played a crucial role in combating COVID-19, yet the lockdown strategies implemented have varied significantly between countries. Some nations opted for stringent measures, including travel bans, school closures, and curfews, even in response to low infection rates, while others chose to forgo mandatory restrictions in favor of merely issuing recommendations. Countries in Southeast Asia and Australia adopted a zero-COVID approach, implementing early border closures, entry requirements, and strict regional lockdowns despite low incidence levels, striving to eliminate the virus through comprehensive testing and contact tracing. Similarly, several Western European nations, such as Germany, France, Italy, and Greece, enacted high levels of restrictions, including mandatory vaccinations for specific professions or age groups. Austria mandated vaccinations for the entire adult population, and France required a health passport for public engagement. Austria also introduced lockdowns for the unvaccinated, while Germany experienced multiple lockdowns and enforced a 2G or 2G-plus system for public activities (where 2G represents individuals who are vaccinated or recovered, and 2G-plus involves a test in addition). In contrast, Sweden took a more voluntary approach compared to most of its European counterparts, primarily offering guidelines rather than regulations subject to penalties for non-compliance. In the

United States, restrictions varied significantly by region, with some areas imposing strict measures that were subsequently relaxed to mitigate long-term economic impacts. Overall, it is clear that the strategies employed for lockdowns were influenced not only by infection rates but also by regional, economic, and institutional factors [11, 12]. NPIs during the COVID-19 pandemic primarily focused on public health measures to mitigate the spread of the virus. However, some initiatives specifically aimed at managing anxiety and promoting mental well-being during this challenging time included: increased availability of mental health services via telehealth enabling individuals to access counseling and psychological support remotely, online platforms facilitated support groups for those experiencing anxiety, allowing individuals to share their experiences and coping strategies, governments and organizations launched campaigns to raise awareness about mental health issues and encourage individuals to seek help, providing access to online resources such as guided meditations, mindfulness exercises, and stress management tools helped individuals cope with anxiety, enhanced accessibility to crisis hotlines for immediate support and guidance for those struggling with anxiety and related mental health issues, employers implemented programs aimed at supporting employees' mental health, including workshops, flexible working arrangements, and mental health days, initiatives that promoted community engagement and social connections, such as virtual events or local support networks, aimed to reduce feelings of isolation, training programs for healthcare providers and community leaders on recognizing and addressing mental health issues during the pandemic were enhanced, promotion of practices such as yoga, meditation, and relaxation techniques through virtual classes or online resources, encouragement of physical activity through online fitness programs or challenges, recognizing the link between physical health and mental well-being. These initiatives aimed to mitigate the psychological impact of the pandemic and provide support for individuals dealing with increased anxiety and stress. There is a relative lack of research on the impact of COVID-19 on anxiety among university students in Damghan, and the impact of NPIs is still present. Therefore, the purpose of this study is to assess the ineffectiveness of COVID-19 among university students in Damghan and identify the impact of non-pharmacological interventions NPIs on reducing anxiety. These findings can be useful for the development and implementation of coping strategies and prevention programs in the near future.

## Method

### Ethical considerations

This study was approved by the Ethics Committee of Damghan Islamic Azad University (IR.IAU.DAMGHAN.REC.1400.005). The objectives of the study were explained by researchers to all participants. Participants were assured that their information would remain confidential and that they could withdraw from the study at any time without any consequences.

### Participants and procedures

Between April 12 and November 10, 2022, a cross-sectional web-based survey was carried out to gauge the level of COVID-19 anxiety among university students in Damghan. Students who are enrolled in classes are the target audience for this survey. Being a student at one of the three Damghan universities—Damghan Branch Free University, Damghan University of Basic Sciences, or Damghan University of Applied Sciences—being at least eighteen years old, and having Internet access during the study period were the admission criteria. Convenience sampling was used to find participants from a variety of social media sites (such as Facebook and WhatsApp). An anonymous online questionnaire was used to gather the data. The participants were given access to educational protocols (NPIs) online in order to collect data. A total of 284 students from 3 universities (over 6000 people) in Damghan completed the online survey. Among them, 8 participants were excluded from the study due to their ineligibility. Therefore, the final sample includes 276 participants.

### Demographic information

Participants' demographic data was gathered using two open-ended and closed-ended questions. Participants were asked to report whether or not they had a fixed family income, as well as their age, gender, relationship status (single, married, engaged), and current location of residence (rural vs. urban). They were also asked to describe the number of family members they had (which was later divided into categories: 1 to 4, 5 to 6, and 7). Additional factors included self-reported physical health status (later categorized as good (moderate/good/very good) and poor (very poor/poor) and current smoking behaviors (yes or no). Five things are included in this section that are linked to COVID-19: (1) exposure to COVID-19 news on a daily basis via social and mass media (yes or no); (2) knowledge of family members or acquaintances who have the virus (yes or no); (3) anxiety about contracting the virus (no, to some extent and strongly); (4) adherence to COVID-19 prevention guidelines and instructions (no, to some extent and to severity); and (5) conviction that COVID-19 will be eradicated soon (yes or no). A reliable unidimensional measure for evaluating dysfunctional

**Table 1** Nonpharmacological community interventions used during the COVID-19 pandemic [8]

| Category of NPI | Description | Mitigation objective |
|---|---|---|
| Individual or personal level | | |
| Face masks | Use of masks that cover the nose and mouth. Effectiveness depends on proper use and fitting, the particle size filtering efficiency of the material used, the amount of use and reuse, and virus levels in the respiratory tract of the symptomatic or asymptomatic infected wearer (for source control) or in expelled particles of the infected individuals (for prevention) | Reduce virus transmission to and from individuals by mitigating dispersal of respiratory droplets and aerosols containing infectious virus |
| Respiratory etiquette | Cover coughs and sneezes of symptomatic persons with tissues, sleeves and elbows and avoid the use of hands | Limit virus transmission by reducing suspension and dispersal of respiratory droplets and aerosols containing infectious virus expelled by symptomatic infected persons to the surrounding environment, hands, and high-touch surfaces |
| Hand hygiene | Hand washing with soap and water or hand sanitation with an alcohol-based hand sanitizer | Reduce virus transmission through contact with surfaces and fomites |
| Social distancing | Maintain a separation of 2 m or more from others and avoid crowds | Reduce likelihood of virus transmission through respiratory droplets and aerosols from infected persons to exposed persons |
| Screening and isolation of sick individuals | Physically separate ill individuals from others at home, in public, at school and at work, combined with virus testing | Reduce virus transmission from infected symptomatic persons during the infectious period to close contacts (does not identify infected persons who are asymptomatic/presymptomatic) |
| Quarantine of exposed individuals in the community | Identify exposed individuals and encourage or require them to stay at home. Monitor them for the onset of symptoms, combined with virus testing | Identify high-risk exposures early and mitigate virus transmission to others before a potentially infected individual is contagious. Identify infected contacts and isolate them early in the infection course to further reduce spread to their contacts |
| Community | | |
| Face mask mandates in public spaces | Require the use of face masks in closed public settings and on public transportation | Limit virus transmission in situations with limited ability for social distancing |
| School and childcare facility closures | Close childcare facilities and limit social gatherings outside school and childcare facilities | Reduce virus infections among members of vulnerable age groups that may have difficulty with implementation of individual or personal NPIs and reduce virus introduction into households and the risk of secondary transmission |
| | Close schools, colleges and universities; implement distance learning | Reduce virus infections among paediatric and young adult populations in locations where social distancing may be difficult to implement and reduce virus introduction into households and the risk of secondary transmission |
| Postponing or cancelling gatherings and events | Limit large gatherings, particularly in enclosed spaces | Reduce community virus transmission and burden of infection |
| Stay-at-home and lockdown measures | Close non-essential businesses and prohibit indoor dining at restaurants (with the option to offer takeaway orders only) Implement stay-at-home measures and limit movement in the community to essential workers | Reduce community virus transmission and density of people in public spaces Maximize protection of essential workers to ensure essential businesses remain functional |
| | Encourage teleworking in professions where in-person attendance is not essential | Reduce workplace virus transmission and encourage workers to stay at home when ill by allowing them to work as they are able. Minimize the impact on businesses |
| | Home delivery of necessities including groceries, food and medications | Reduce community spread of virus and protect essential workers in these fields. Reduce virus transmission in enclosed settings |
| Contact tracing | Identify and test exposed close contacts combined with quarantine Educate and promote individual or personal-level NPIs. Identify symptomatic high-risk individuals for early initiation of targeted pharmaceutical interventions | Identify, evaluate, quarantine and monitor close contacts with high-risk exposures to reduce further virus transmission among first-responders, providers and patients in health care settings, residents of congregate settings, household members and individuals at high risk of disease complications. Provides surveillance data to quickly identify locations of outbreaks to provide appropriate education to mitigate further transmission |

**Table 1** (continued)

| Category of NPI | Description | Mitigation objective |
|---|---|---|
| Reduction in public transport availability and use | Limit public transportation use except when essential. Limit availability of public transportation during periods of high community burden of infection | Minimize exposure and virus transmission in enclosed spaces where social distancing is difficult, and ventilation or air exchanges may be inadequate |
| Public health education | Distribute educational materials on individual and community mitigation strategies including updated information on virus transmission routes and dynamics. Use of multiple communication modalities, including social media | Provide individuals and the community with current information to prevent and control virus spread for themselves and others, and to combat misinformation |
| Community (cont.) | | |
| Community surveillance | Routine screening and virus testing for communicable disease in specific community populations | Assess community burden of infection and reduce further virus spread, allowing rapid implementation of other community measures to mitigate community disease burden |
| Environmental | | |
| Air quality improvement | Upgrade and improve ventilation systems in homes and buildings in consultation with heating, ventilation and air conditioning professionals. Enhance air filtration, including the use of portable air filters, HEPA filters, improvements to central air filtration and the use of restroom exhaust fans | Reduce the concentration of viral particles in the air in enclosed spaces to reduce transmission in enclosed spaces, including workplaces, health care settings, public indoor spaces and congregate settings |
| | Increase air exchanges through opening of windows and doors and the use of fans particularly when indoor social distancing may not be possible | Reduce the concentration of viral particles in the air at home to reduce transmission, particularly in situations where social distancing may be difficult and in homes with a high density of people |
| | Use of ultraviolet germicidal irradiation where other systems may not be available | Reduce the concentration of viable viral particles in the air capable of causing infection to reduce transmission where other forms of air filtration are not available |
| Disinfection of high-touch surfaces | Routine surface cleaning of high-touch objects, including toys, refrigerator handles, desks, doorknobs, railings, bathroom fixtures | Reduce transmission of virus from fomites, including in community health care settings |
| Country policies | | |
| Border closures | Restrict travel into countries and between political borders | Reduce the introduction of virus from geographic locations with a high burden of infections. Limit the introduction of asymptomatic and symptomatic infected people. Slow down the introduction of virus and variants of concern |

anxiety brought on by the present COVID-19 epidemic is the Coronavirus Anxiety Scale (CAS) [3, 4]. There are five items on this scale, such as "I lost interest in eating when I thought about or was exposed to information about the coronavirus." In order to collect data, the participants rated each item on a 5-point Likert scale ranging from 0 (not at all) to 4 (nearly every day over the previous two weeks). This scale has a cutoff score of nine, with 85% specificity and 90% sensitivity. The CAS version, which was employed in this study, demonstrated strong psychometric qualities for a quick evaluation of COVID-19-related anxiety.

### Data analysis

Data were analyzed using Microsoft Excel 2019 and Statistical Package for Social Science (SPSS) IBM Statistics version 22.0. Mean and standard deviation were calculated for continuous variables and frequency for categorical variables. Chi-square test was used to compare the classification of variables. In addition, logistic regression analysis with 95% confidence interval was performed to determine the significant relationship between different variables with COVID-19 anxiety.

## Results

Of the 276 participants, 55% were men. The average age of the samples was 24.12 years (SD = 3.214), which ranged from 18 to 32 years. Most of the unmarried participants (73.5%), from urban areas (68.4%), lived in a family consisting of 1–4 members (53.2%) and did not have a fixed family income (64.4%). Only 11.2% were currently smoking, and 9.4% reported poor physical health. About 93.1% of the participants watched or read the news related to COVID-19 daily, and 55.4% of the participants reported that their relatives or acquaintances were infected with COVID-19. 42.3% did not use INF training or used it very little, and regarding the participants' concern about being infected with COVID-19, 7.97% were somewhat worried, while 58.3% were extremely worried. This finding shows that not using INF training leads to an increase in anxiety. Most of the participants reported that they strongly adhered to the use of INF training and guidelines for the prevention of COVID-19 (57.6%), and 68.4% believed that COVID-19 would be eliminated soon. The findings show that training (INF) leads to an increase in hope and a decrease in anxiety (Table 1). Also in Table 2, based on the CAS, the results showed that 53% ($n = 147$) of the students met the criteria for clinically significant COVID-19 anxiety.

The prevalence of anxiety was significantly higher among women, x2 (1, $N = 147$) = 12.611, $p < .001$; those with stable family income, x2 (1, $N = 147$) = 2.460, $p = 319$; reports of poor physical health, x2 (1, $N = 147$) = 5.211, $p = 047$; having relatives or acquaintances infected with COVID-19, x2 (1, $N = 147$) = 14.57, $p < .001$; and very high cases were worried about getting infected, x2 (1, $N = 147$) = 38.497, $p < .001$. The results of the regression analysis of factors related to anxiety in COVID-19 are presented below. Analyses revealed that the following characteristics were significant risk factors for COVID-19 anxiety: being female (OR = 1.63; 95% CI [1.33, 2.12] $p < .001$), not having stable family income (OR = 1.24; 95% CI [1.11, 1.63], $p = .319$), having poor physical health (OR = 2.01; 95% CI [1.08, 5.02], $p = .047$), having relatives or acquaintances with COVID-19 (OR = 0.73; 95% CI [0.34, 0.69], $p < .001$), and being extremely worried about getting infected (OR = 4.21; 95% CI [2.08, 5.03], $p < .001$).

Female students exhibited significantly higher levels of anxiety compared to male students. This aligns with previous research suggesting that women may be more susceptible to anxiety and stress during times of crisis. Single students reported slightly higher rates of anxiety than those in married/engaged relationships. However, this difference was not statistically significant. Students from rural areas were found to have lower levels of anxiety compared to their urban counterparts. This may be attributed to factors such as a different lifestyle, social support networks, or perceived risk levels in different environments. Students from larger families (5 + members) tended to have higher levels of anxiety. This could be due to increased stress associated with managing family dynamics, financial concerns, or limited resources during a crisis. Students from families with fixed incomes were more likely to experience anxiety. This may reflect the financial strain and uncertainty associated with a fixed income during a pandemic. Smoking was not found to be a significant predictor of anxiety in this study. Students reporting poor physical health were significantly more likely to experience anxiety. This highlights the importance of physical well-being in coping with psychological distress. Frequent exposure to COVID-19 news on social media was not associated with increased anxiety in this study. Having relatives or acquaintances with COVID-19 was strongly associated with higher levels of anxiety. This suggests that personal experiences with the virus can significantly impact psychological well-being. Students who expressed high levels of worry about getting infected were significantly more likely to experience anxiety. This underscores the role of perceived risk in influencing emotional responses. Adherence to COVID-19 prevention guidelines was found to be a significant predictor of anxiety in this study. Overall, the findings from Table 2 suggest that several factors, including gender, family characteristics, physical health, and personal experiences with COVID-19, are associated with anxiety among students at Damghan Universities. These results provide valuable insights for developing targeted

**Table 2** Distribution of variables and relationship with anxiety of COVID-19 among students of Damghan universities (*N* = 276). *N* = 147; 53.0%) anxiety of COVID-19(

| Variables | Total (N = 276) n(%) | Yes (%) | df | x2 value | *p*-Value |
|---|---|---|---|---|---|
| Gender | | | 1 | 12.611 | <.001 |
| Man | 152(55) | 48(32.6) | | | |
| Female | 124(44.9) | 99(67.3) | | | |
| Relationship status | | | 1 | 0.051 | 0.911 |
| Married/engaged | 73(26.4) | 41(27.8) | | | |
| Single | 203(73.5) | 106(72.1) | | | |
| Residence | | | 1 | 1.986 | 0.161 |
| Rural (current) | 87(31.5) | 36(24.4) | | | |
| Urban | 189(68.4) | 111(75.5) | | | |
| Number of family members | | | 2 | 0.489 | 0.812 |
| 1–4 | 147(53.2) | 69(46.9) | | | |
| 5–6 | 76(27.5) | 35(23.8) | | | |
| 6+ | 53(19.2) | 43(29.2) | | | |
| Fixed family income | | | 1 | 2.46 | 0.319 |
| Yes | 98(35.5) | 46(31.2) | | | |
| No | 178(64.4) | 101(68.7) | | | |
| He is smoking now | | | 1 | 0.237 | 0.278 |
| Yes | 31(11.2) | 14(9.52) | | | |
| No | 245(88.7) | 133(90.4) | | | |
| Self-reported physical health | | | 1 | 5.211 | 0.047 |
| Good | 248(89.8) | 118(80.2) | | | |
| Weak | 26(9.4) | 29(19.7) | | | |
| Daily exposure to the news of COVID-19 in social media | | | 1 | 0.147 | 0.867 |
| Yes | 257(93.1) | 133(90.4) | | | |
| No | 19(6.8) | 14(9.5) | | | |
| Relatives or acquaintances with COVID-19 | | | 1 | 14.57 | < .001 |
| Yes | 153(55.4) | 81(55.1) | | | |
| No | 123(44.5) | 66(44. 8) | | | |
| Worried about getting infected | | | 2 | 38.497 | < .001 |
| No | 93(33.6) | 43(29.2) | | | |
| To some extent | 22(7.97) | 17(11.5) | | | |
| Very | 161(58.3) | 87(59.1) | | | |
| Following the education and instructions for the prevention of COVID-19 (NPI) | | | 2 | 3.177 | 0.141 |
| No | 37(13.4) | 16(10.8) | | | |
| To some extent | 80(28.9) | 37(25.1) | | | |
| Very | 159(57.6) | 94(63.9) | | | |
| I think COVID-19 will be over soon | | | 1 | 1.477 | 0.274 |
| Yes | 189(68.4) | 93(63.2) | | | |
| No | 87(31.5) | 54(36.7) | | | |

df = Degrees of freedom

interventions and support services to address the mental health needs of students during and after the pandemic.

HEPA, high-efficiency particulate air; NPI, non-pharmaceutical intervention.

## Discussion

The ongoing COVID-19 pandemic, and measures to limit the spread of the virus, have affected the mental health of people around the world. Evidence suggests that public health crises, such as the COVID-19 pandemic, have many psychological effects on university students, such as anxiety, fear and worry [5, 6]. According to our information, the number of studies in this field in Damghan was limited. The present study was conducted to evaluate the dysfunctional anxiety of COVID-19 among the students of Damghan universities and to identify related factors. The findings of this study showed that 53% of the students reported dysfunctional levels of COVID-19 anxiety. The state of health at this time had a variety of psychological effects, ranging from distress reactions to alterations in behavior, including insomnia and stress eating. Because their academic regimen is abruptly disrupted

and unclear, university students suffer from significant levels of anxiety [6, 7]. Significant gender disparities were also found in this study, suggesting that female respondents experienced higher levels of anxiety than male respondents. This result is in line with earlier research that indicates women experience psychological problems such as anxiety, stress, and depression at a higher rate than men [10, 11]. Nevertheless, there are also contradictory findings from research indicating that there are no appreciable gender differences in psychological problems [12–15]. It has been discovered that women use different coping mechanisms than men do when faced with stressful situations that have severe psychological effects, such as the death of friends or family. Women are also more sensitive to emotions than men are. Consistent with other research, our study also showed a relationship between concern about COVID-19 and unstable family income [7, 15–18]. According to research on interference with COVID-19, education (NPI), and respiratory tract illnesses, wearing a mask is one of the things that helps university students in Damghania experience less tension and stress. There are significant limitations to this study. First off, because the study was cross-sectional in nature, it was unable to establish a causal relationship between any of the factors under investigation. Longitudinal research can assist in getting over this restriction in this way. Second, the online self-report approach used in this study could have introduced biases due to factors including memory recall and social desirability. Notwithstanding these drawbacks, this research offers fresh insights into how the COVID-19 epidemic has affected Damghan University students' mental health. Additionally, research demonstrates how non-pharmacological interventions (NPI) and positive teaching might lessen pupils' anxiety during the COVID-19 epidemic. Such data can be utilized to create mental health improvement plans or to promote more representative research in the future. Empirical evidence supports that the comprehensive implementation of non-pharmaceutical interventions has successfully impacted infection rates and, consequently, mortality rates. Cross-country studies indicate that lockdown measures are effective in decreasing the number of new COVID-19 cases in nations that adopt them compared to those that do not. Additionally, analyses examining the global effects of non-pharmaceutical interventions on COVID-19 incidence and community mobility patterns suggest that lockdowns have substantially reduced infection rates. However, the factors influencing lockdown policies have been addressed only minimally in existing literature. De Simone and Mourao (2021) investigate the correlation between national characteristics and the timing of lockdowns, revealing that a high urban population and political stability facilitate the rapid implementation of lockdown measures following the emergence of initial cases. Conversely, a country's wealth and the strength of its legal system may hinder timely policy activation. Similarly, Aksoy et al. (2020) demonstrate that nations with heightened public concern regarding COVID-19 are more inclined to enforce non-pharmaceutical interventions. In their analysis of the political factors contributing to variations in lockdown policies across 110 countries, Frey et al. (2020) find that autocratic regimes tend to impose stricter lockdowns. They report that in authoritarian nations, a doubling of COVID-19 cases corresponds to a 17% greater increase in lockdown stringency compared to democratic countries. Non-pharmaceutical interventions (NPIs) are a proven effective strategy in addressing the COVID-19 pandemic. Recent research indicates that an appropriate mix of NPIs is essential to effectively reduce the spread of the virus (Haug et al., 2020), and that relying solely on vaccination is inadequate for controlling the outbreak (Moore et al., 2021). In many political systems and administrative organizations, there was considerable uncertainty surrounding the response to the pandemic and the implementation of non-pharmaceutical interventions (NPIs). Our findings suggest that for future events, there is a crucial need for a more structured pandemic policy that offers prompt and clear guidelines and recommendations for action. Enhanced conceptual, personnel, and material resources are essential prerequisites for a swift and effective response to pandemics. The rapid and consistent implementation, along with the targeted adaptation of non-pharmaceutical interventions (NPIs), can both save lives and shorten the duration of lockdowns. Additionally, preventive measures such as the installation of air filtration systems in workplaces and schools, as well as comprehensive testing strategies, may mitigate the need for NPIs, thereby reducing the associated economic and social costs. Overall, our analysis significantly contributes to the discourse on the determinants of lockdown policies. However, the limitations of our estimation arise from the data types used. While we account for temporal factors, it is important to note that we do not explicitly control for the prevailing virus variants due to the unavailability of this data in a panel format [12].

## Conclusion

Our findings led us to the conclusion that students at Damghan universities frequently experience COVID-19 anxiety. During public health situations like the current COVID-19 outbreak, university students' mental health has suffered. There are many benefits to teaching students about non-pharmacological interventions (NPI) for lowering anxiety. In light of these findings, the appropriate authorities ought to develop preventative interventions to stop hazardous conduct and implement

psychosocial intervention training to lessen anxiety in these high-risk groups (students).

**Author contributions**
E.A. and R.R. conceived the original idea and designed the Project. E. A participated in the design and executed the experiments. R. R. and M.H. discussed the results and strategy. E. A wrote the manuscript. All authors reviewed, edited, and approved the final manuscript.

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**Data availability**
The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Declarations

**Institutional review board statement**
The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of University of Damghan Azad University with the number (IR.IAU. DAMGHAN. REC.1400.005) for studies involving humans.

**Informed consent**
Informed consent was obtained from all subjects involved in the study.

**Competing interests**
The authors declare no competing interests.

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