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REPUBLIC OF TURKEY
HACETTEPE UNIVERSITY
GRADUATE SCHOOL OF HEALTH SCIENCES

KNOWLEDGE AND BEHAVIOR OF INTERNATIONAL STUDENTS STUDYING HIGHER EDUCATION IN TURKEY TOWARDS PERSONAL PROTECTIVE MEASURES AGAINST COVID-19

Abednego Nzyuko MASAI

Public Health

MASTER OF SCIENCE (MSc) THESIS

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YAYIMLAMA VE FİKRİ MÜLKİYET HAKLARI BEYANI

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ETHICAL DECLARATION

In this thesis study, I declare that all the information and documents have been obtained in the base of the academic rules and all audio-visual and written information and results have been presented according to the rules of scientific ethics. I did not do any distortion in data set. In case of using other works, related studies have been fully cited in accordance with the scientific standards. I also declare that my thesis study is original except cited references. It was produced by myself in consultation with supervisor Prof. Dr. Levent AKIN and written according to the rules of thesis writing of Hacettepe University Institute of Health Sciences.

Abednego Nzyuko MASAI

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ABSTRACT

Masai, A.N., Knowledge and Behavior of International Students Studying Higher Education in Turkey towards Personal Protective Measures against COVID-19, Hacettepe University Graduate School of Health Sciences Department of Public Health Master of Science Thesis, Ankara, 2021. The study aim was to investigate implementation of personal protective measures among international students during COVID-19 pandemic. A total of 758 students from 95 countries were observed between October 2020 and March 2021. Their frequency of implementing the personal protective measures and their reported cases of ILIs were examined. Kaplan-Meier analysis was used to compare the occurrence of symptoms of ILIs among students who adhered and those who did not adhere to the measures. A multivariate Cox proportional regression was performed to investigate the relationships between frequency of implementing the personal protective measures and reported cases of ILIs. A total of 139 (18.3%) students reported symptoms of ILIs. Study findings showed that students who frequently wore facemasks were 33.6% less likely to show symptoms of ILIs adjusting for all the other personal protective measures (HR=0.664, 95%CI=0.494-0.893, p=0.006). Students who frequently disinfected their hands were 17.1 % less likely to report symptoms of ILIs (HR=0.821, 95%CI=0.793- 0.915, p=0.029). Furthermore, students who exercised social distancing measures were 23.5% less likely to report symptoms of ILIs adjusting for the other measures (HR= 0.765, 95%CI=0.610 - 0.960, p=0.020). Students whose personal protective measures were below the median were found to experience 2 times more cases of ILIs than students who scored above the median (HR=2.16, 95%CI=1.53-3.05, P<0.001). Study findings indicate the need to train students how to protect themselves from common airborne infections. The study also provides information about the effectiveness of personal protective measures in preventing acute respiratory infections among international students.

Key Words: Behavioral change; Influenza-like illness**;** International students; Personal protective measures

ÖZET

Masai, A.N., Türkiye'de Yüksek Öğrenim Gören Uluslararası Öğrencilerinin COVID-19'a karşı Kişisel Korunma Hakkındaki Bilgi ve Davranışları, Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü Halk Sağlığı Anabilim Dalı Yüksek Lisans Tezi, Ankara, 2021. Bu çalışma koronavirüs salgını sırasında uluslararası öğrencilerin kişisel koruyucu önlemler uygulanmalarını amaçlanmıştır. Ekim 2020 ile Mart 2021 tarihleri arasında 95 ülkeden gelen 758 uluslararası öğrenci izlenmiştir. Kişisel koruyucu önlemleri uygulama sıklıkları ve bildirilen GBH vakaları incelenmiştir. Kaplan-Meier analizi, kişisel koruyucu önlemlere uyan ve uymayan öğrenciler arasında GBH semptomlarının oluşumunu karşılaştırmak için kullanılmıştır. Çok değişkenli Cox regresyon anlalizi, kişisel koruyucu önlemleri uygulama sıklığı ve bildirilen GBH vakaları arasındaki ilişkileri incelemek için kullanılmıştır. Toplam 139 (% 18, 3) öğrenci grip benzeri hastalık belirtileri bildirmiştir. Sık sık maske kullanan öğrencilerin GBH belirtilerini gösterme olasılıklarının % 33,6 daha az olduğu görülmüştür (Hazard Oranı = 0,664, % 95 CI = 0,494-0,893, p = 0,006). Ellerini sık sık dezenfekte eden öğrencilerin GBH belirtilerini göstereme olasılıkları % 17,1 daha düşük olmuştur (Hazard Oranı = 0,821, % 95 CI = 0,793-0,915, p = 0,029). Dahası, sosyal mesafe uygulayan öğrencilerin GBH belirtilerini gösterme olasılıkları % 23,5 daha düşüktü (Hazard Oranı = 0,765, % 95 CI = 0,610 - 0,960, p = 0,020). Kişisel koruyucu önlemleri medyanın altında olan öğrencilerin, medyanın üstünde puan alan öğrencilere göre 2 kat daha fazla GBH gösterdikleri görülmüştür (Hazard Oranı = 2,16, % 95 CI = 1,53-3,05). Çalışma bulguları, öğrencileri yaygın havayolu enfeksiyonlardan nasıl koruyacaklarını eğitim programlarının başlatılması ihtiyacını göstermektedir. Çalışma ayrıca, uluslararası öğrenciler arasında akut solunum yolu enfeksiyonlarını önlemede kişisel koruyucu önlemlerin etkinliği hakkında bilgi sağlamaktadır.

Anahtar Sözcükler: Davranış değişikliği; Grip benzeri hastalık; Uluslararası öğrenci; Kişisel koruyucu önlem

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LIST OF ABBREVIATIONS

ACE-2 receptor	Angiotensin-converting enzyme receptor 2
AdV	Adenovirus
COVID-19	Coronavirus disease 2019
HCoV-OC45	Human coronavirus OC45
HCoV-229E	Human coronavirus 229E
HCoV-NL63	Human coronavirus NL63
HCoV-HKU1	Human coronavirus HKU1
ILIs	Influenza-like illnesses
MERS	Middle East Respiratory Syndrome
MERS-CoV	Middle East Respiratory Syndrome Coronavirus
NPIs	Non-pharmaceutical Interventions
ORF	Open Reading Frame
PIV	Parainfluenza virus
PPM	Personal protective measures against COVID-19
RSV	Respiratory Syncytial Virus
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-1	Severe Acute Respiratory Syndrome Coronavirus 1
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
TMPRSS2	Transmembrane serine protease 2
URTI	Upper Respiratory Tract Infection

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1. INTRODUCTION

Since its emergence, COVID-19 (coronavirus disease 2019) has affected the daily life of nearly all of the human population. Many people have drastically changed their behaviors during the last year to protect themselves from the infection with the coronavirus (1). In the past two decades, two coronaviruses (SARS and MERS) have also emerged in the human population (2-4), causing a high global public health alert (5). Many countries advised their citizens to stay at home, wear facemasks, disinfect their hands, and maintain a distance of at least 1.5 meters (6, 7) to reduce its spread. In addition, they enforced school closures, curfew restrictions, restrictions of mass gatherings, quarantine of positive individuals, and restriction of international flights despite the economic repercussions of these interventions (8). These non-pharmaceutical interventions (NPIs) are effective in not only reducing COVID-19 spread but also in preventing transmission of other respiratory infections (9). The effectiveness of NPIs in reducing infections from respiratory viruses depends on the timing, duration, and combinations of different interventions (10).

Behavioral changes to protect against the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) can potentially protect against other respiratory infections (12, 13) since COVID-19 and influenza-like illnesses (ILIs) spread primarily through the respiratory route (11). Indeed, indicators of influenza activity and proportion of consultations for ILIs declined sharply during the 2019-2020 flu season after recognition of the widespread community transmission of COVID-19 (14). Peoples' behavioral changes during the coronavirus pandemic including practicing measures to protect themselves from COVID-19 and hospital-seeking behaviors, moderated the observed cases of influenza and influenza-like illnesses

This study drew on the framework of the measures recommended by the World Health Organization (WHO) to protect people against infection during the coronavirus pandemic, each of which is discussed in the general information section. These measures

have so far been effective in mitigating COVID-19 transmission. However, several individual variables (age, gender, country of origin, behaviors, economic level, and perception of risk) and group-level variables (host country, location of residence, and culture), which existed before the emergence of the coronavirus pandemic, can modulate the implementation of these measures. According to a study by Machida and colleagues, gender, age, and economic level were significant factors that influenced the adoption of personal protective measures (15). Other studies have shown that people from countries where government policies and culture support the measures have a higher implementation (16). These factors come together to influence people's attitude towards wearing facemask, hand hygiene, physical distancing, surface disinfection, avoiding crowded places, and respiratory etiquette measures during the coronavirus pandemic. Previous studies have analyzed the people's practice of wearing facemask, social distancing, hand hygiene, surface disinfection, and avoiding crowded places during different phases of the coronavirus pandemic (15, 17). Evidence of implementation of the personal protective measure and the role of these measures in preventing acute respiratory infections in the international student population is limited.

International students are among the population faced with the challenge of protecting themselves from COVID-19 while away from their families. These students experience numerous challenges when transitioning to a new county (18, 19). Indeed, some students who have pre-existing challenges associated with adapting to a new culture, social, and in some cases language (20) have also had to change their behaviors to protect their health during the coronavirus pandemic (21). Moreover, international students hesitate and delay to visit hospitals when they are ill (23). Thus, their information may not be captured in hospital visits for complaints of acute respiratory infections. Besides, delays in testing, treatment, and quarantine of infected individuals can result in the spread of the virus to the population and (or) severe complications in the context of the coronavirus pandemic. It can also be catastrophic to an infected individual if the disease is treatable, but he/she does not receive healthcare in time. Furthermore, lack of social support network, isolation, uncertainties, and the inability to travel back to

their families during the coronavirus pandemic can cause stress and anxiety among international students (23, 24).

Therefore, international students' knowledge of the COVID-19 and their implementation of facemasks, hand hygiene, social distancing, and surface disinfection measures to protect themselves from the SARS-CoV-2 is essential. The health and well-being of international students goes beyond the absence of disease (25). Their physical, social, and mental health and well-being ought to be closely monitored (26), especially during the current coronavirus pandemic. The present study aimed to investigate international students' behavioral changes due to COVID-19 by observing a group of international students during the 2020-2021 flu season. The study assessed whether the individual and group factors influenced the adoption of personal protective measures among international students. The study also investigated the frequency of influenza-like illnesses during the 2020-2021 flu season and examined relationships between the students' adherence to measures against COVID-19 and the observed cases of ILIs. This study is significant because it expands the current knowledge on international students' protection in the event of epidemics and informs planning on effective strategies to promote health and wellbeing among international students. The study also provides information about the effectiveness of personal protective measures in preventing other transmissions of respiratory infections among students.

1.1. Study Objectives

The study objectives are;

- to investigate the frequency of influenza-like illnesses among international students on Türkiye Scholarship enrolled in higher education in Ankara during 2020-2021 flu season,
- to investigate the level of personal protective measures used by this group "Türkiye Scholarship" of students,
- to determine behavioral changes caused by the COVID-19 pandemic during the 2020-2021 flu season.

2. GENERAL INFORMATION

2.1. SARS-CoV-2 virology and replication

To date, there are seven coronaviruses that caused respiratory infections in human population (27). These include four coronaviruses (HCoV-229E, HCoV-HKU1, HCoV-NL63, and HCoV-OC43) which are responsıble for 20 % of the upper respiratory infections (URTI) (28) and the coronaviruses that caused the SARS, MERS, and COVID-19 (29). The genome of SARS-CoV-2 has similarities with SARS-CoV-1 (80%) (30).

The SARS-CoV-2 viral envelope contains envelop (E), membrane (M), and spike (S) proteins (31). Two subunits, S1 and S2 constitute the spike protein. The viral S1 subunit contains a receptor-binding domain, which binds to the angiotensin-converting enzyme (ACE-2) receptor 2 (31, 32). The ACE-2 receptors are located on the lung alveolar epithelial cells, the vascular endothelial cells, and the small intestine epithelial cells (33). The S2 subunit, a relatively conserved subunit compared to the S1 subunit, mediates the fusion of viral envelops with the cell membranes (34-36). Most coronavirus vaccines stimulate antibody and T cell production by inducing cells to produce the spike (S) proteins (37). The viral nucleus contains a 125nm, single-stranded, 30 kb positive sense ribonucleic acid (+ RNA) genome. The viral RNA contains 14 open reading frames (ORFs) which encode for 27 proteins (38).

After the viral S1 domain binds ACE-2 receptor, the TMPRSS2 (Transmembrane serine protease 2), a type 2 serine protease located on the surface of cells cleaves the Spike glycoprotein activating the virus (Figure 3.1). This process facilitates the entry of the virus into the cell membrane. Once in the cellular membrane, the positive-sense RNA is replicated to a negative sense RNA by the Replicase-Transcriptase complex. The complex uses the negative-sense RNA to replicate more copies of a positive sense of viral RNA. The SAR-CoV-2 uses hosts ribosomes to translate the genetic information in the RNA to proteins. Protease enzymes cleave polyproteins, which assemble with the

viral nucleocapsid. The viral particles mature and bud from the cell membrane to infect other cells (39, 40).

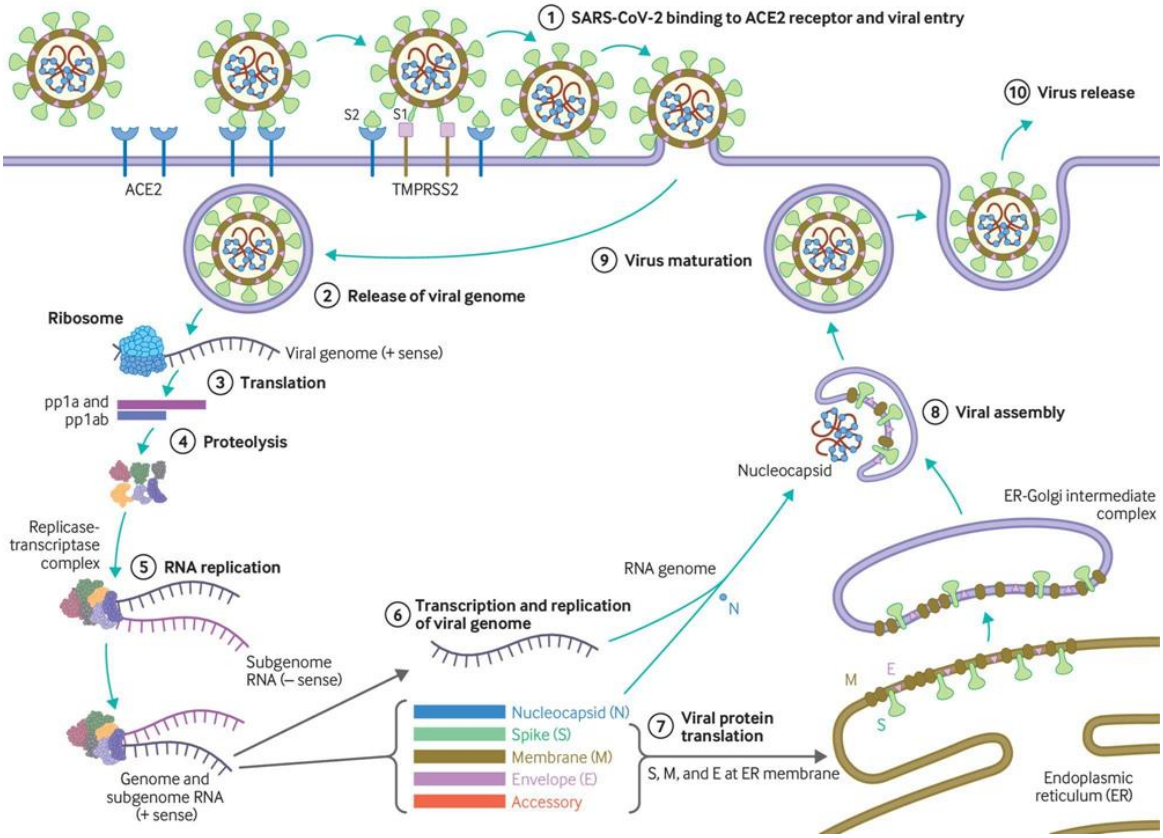


Figure 2.1. Transmission and pathogenesis of SARS-CoV-2 virus **(**40).

2.2. Upper Respiratory Tract infections (URTIs)

The nasopharyngeal tract is predisposed to infections (41). Upper respiratory tract infections (URTI) present a wide range of symptoms and severity because of closely adjacent anatomical sites (42). The term "URTI" refers to acute infections of the nose, throat, larynx, pharynx, trachea, and sinuses (43). URTIs can occur with or without a lower respiratory tract infection (42, 43). Viruses are the major cause of URTIs (44). The viruses that are known to cause URTIs include human rhinoviruses, respiratory syncytial viruses (RSV), human coronaviruses (HCoV), parainfluenza viruses (PIV), adenoviruses, and enteroviruses (44, 45).

URTIs form a considerable proportion of outpatient consultation and contribute to both economic losses and co-morbidities, especially during cold seasons (46). During the winter season, people spend more time indoors. The increased contact between people facilitates the transmission of respiratory viruses from one person to another (47). Furthermore, humidity during cold seasons may contribute to increased URTI cases because the causative viruses thrive in high humidity (48). With a variable presentation of symptoms, it is difficult to distinguish between COVID-19 and URTIs based on symptoms alone (49, 50). Since COVID-19 and URTIs spread primarily through inhalation of respiratory droplets, personal protection interventions against COVID-19 such as wearing facemasks, social distancing, hand hygiene, and surface disinfection can potentially reduce transmission of URTIs (11, 51).

Table 2.1. Viral causes of upper respiratory tract infections (52-54)

Family	Virus	Envelope	Viral nucleotide	Size (nm)	Expected months when cases peaks
Adenoviridae	Adenovirus	Non-enveloped	Double stranded DNA	90-100	December-March
Coronaviridae	Human coronaviruses (HCoV)	Enveloped	(+) Single stranded RNA	65-125	December-February
Picornaviridae	Rhinovirus	Non-enveloped	(+) Single stranded RNA	30	October-November
	Respiratory enterovirus	Non-enveloped	(+) Single stranded RNA	25-30	July-August
Paramyxoviridae	Respiratory Syncytial virus (RSV)	Enveloped	(-) Single stranded RNA	150-200	December-February
	Human parainfluenza virus (HPIV1 & HPIV2)	Enveloped	(-) Single stranded RNA	150-200	September – December & March-April
Orthormyxoviridae	Influenza	Enveloped	(-) single stranded RNA	80-120	December-February

During the winter season, (December- March) URTIs cases caused by HCoV, HPIV, Influenza and adenoviruses peak.

2.3. Influenza-like illnesses (ILIs)

The WHO case definition of ILIs is an acute respiratory infection with an onset within 10 days, fever of greater than 38 degree Celsius, and a cough in the absence of an alternative causative agent (55). During peak seasons, the influenza virus can be responsible for 35-45 % cases of influenza-like illnesses (56). Other viruses that cause ILIs include respiratory syncytial viruses (RSV), human coronaviruses (HCoV), parainfluenza viruses (PIV), and adenoviruses (56).

In ILIs, body aches, malaise, nausea, headaches, loss of appetite, coughs, and nasal blockages symptoms appear abruptly and lasts for about 5-7 days (57, 58). It is difficult to determine the causative agent of ILIs principally by observing signs and symptoms (57, 58). Cases of respiratory infections peak during flu season. In Turkey, the flu season starts in October and lasts until May (59). During this period, there is an increase in the circulating influenza virus, RSV, rhinovirus, and human coronaviruses among viruses that cause respiratory infection (59). During the winter season, these respiratory viruses spread easily because people spend more time indoors and have close contact (58, 59). During the 2019-2020 flu season, about 15 % of people who presented with upper respiratory symptoms in Turkey were found to have the influenza virus (59). It was also observed that rhinovirus and parainfluenza viruses caused similar symptoms (59).

2.4. Personal protective measures against COVID-19

2.4.1. Facemasks

COVID-19 spreads primarily through inhalation of droplets (60). The term "facemask" broadly refers to the protective covering of the nose and mouth or entire face that primarily reduces transmission of droplets (60). Facemasks were shown to be applicable as early as the late nineteenth century (1897) when Carl Friedrich Flügge, a hygienist, working on the development of respiratory droplets demonstrated that surgical masks could be used (61). Research on the facemasks continued during the 1930s and in the 1960s, the use of disposable masks was globally accepted (61).

The use of facemask by the general population during the coronavirus pandemic became apparent after studies showed that both symptomatic and asymptomatic people shed SARS-CoV-2 through droplets (62). Facemasks reduce the spread of COVID-19 by protecting an individual from inhaling droplets (63) and preventing transmission of the virus by either an asymptomatic or symptomatic person (64). According to the CDC, 20-40 % of people infected with COVID-19 are asymptomatic (65). Masking protects individuals from COVID-19 infection and reduces the severity of the infection if they are infected by preventing inhalation or reducing the inoculum of the virus inhaled. The result of this is a shift of symptomatic to asymptomatic infections (66).

Population-wide use of facemasks has been shown to lower severe cases, hospitalization, and deaths from the COVID-19 (67). At the same time, facemasks have been shown to increase the proportion of asymptomatic cases (67, 68). Studies using animal models showed that hamsters with masking were less likely to be infected and were asymptomatic or exhibited milder symptoms when they did get infected (68). In a systematic review conducted by Chu and colleagues, cloth and surgical facemasks offered 67 % protection to the wearer (69). Although the SARS-CoV-2 measures 0.1

micrometers, it spreads in droplets greater than 5 micrometers or in aerosols (70). Therefore, the use of facemasks prevents inhalation of the virus-containing droplets.

2.4.2. Physical distancing

Physical distancing is one of the primary non-pharmaceutical interventions adopted in combating the coronavirus pandemic. The term “social distancing” refers to keeping a distance of about 1.5 meters between a person and the members who are not his/her household in both indoor and outdoor spaces (71). Since the coronavirus spreads through respiratory droplets, distancing reduces the risk of contracting the virus transported in the droplets.

To protect themselves and others from infection with the SARS-CoV-2 virus, the WHO and CDC advised people to maintain a distance of 1.5 meters. Indeed, studies have shown that communities with higher social distancing have a reduced risk of COVID-19 compared to those with lower social distancing (72). Increased social distancing measures, including stay-at-home orders, non-essential business closures, restriction of public mass gatherings, adopted by many countries to combat the spread of COVID-19, lowered the epidemic curve but negatively impacted the economy.

In addition to spreading through respiratory droplets, the SARS-CoV-2 also spreads through aerosols (73). Aerosols are small (<5 micrometers) suspensions of liquid or solid particles, which suspend in the air over time and distance (74). Liquid droplets can also evaporate in the air to form aerosols referred to as droplet nuclei (74). Infectious aerosols contain infectious viruses, bacteria, or fungi, which can travel through the air (74). While respiratory droplets measuring 60-100 micrometers emitted fall on the ground within approximately 2 meters, sneezing increases the distance of spread of the respiratory droplets to 6 meters (75). Besides, aerosols have been shown to travel as far as 7-8 meters (76). The particle (aerosol/droplet) size and electrostatic effects affect the location where particles loges in the airway (77). Droplets greater than 8 micrometers

are trapped in the upper respiratory tract-nasopharynx, whereas aerosols have the potential of traveling to the alveoli and the lungs (78). Therefore, social distance coupled with masking prevents the coronavirus transmission through droplets and aerosols to the air slowing down the spread of COVID-19.

2.4.3. Hand hygiene and surface disinfection

COVID-19 is not only spread by inhalation of droplets or aerosols but also touching contaminated surfaces (79). The SAR-CoV-2 can remain viable on surfaces for several hours depending on the environmental conditions (80). A study by Neeltje van Doremalen and colleagues showed that although the coronavirus titer reduced considerably, viable coronavirus persisted in steel and plastic for up to 48 and 72 hours, respectively (81). Hand washing or disinfecting hands with a sanitizer containing a minimum of 60 % alcohol was adopted as one of the principal personal protective measures against COVID-19 (82). The soap contains a hydrophilic head and hydrophilic tail. During hand washing, the hydrophilic head is attracted to water, and the hydrophobic tail gets attracted to viral particles, piercing the viral outer layer and releasing contents of the virus (80, 83). While alcohol-based hand sanitizers split viruses apart, they do not wash away viral contents from the skin (84). Furthermore, they may result in allergic reactions and contact dermatitis (84). Therefore, the WHO recommended using alcohol-based hand sanitizers in the event an individual cannot wash hands with soap and water (85).

Since the SARS-CoV-2 persists in the environment, regular surface disinfection is recommended. Viral agents that cause respiratory infections can persist in the environment for several hours. Enveloped viruses like COVID-19 can degrade when with cleaning agents that contain surfactant (86). Previous studies have shown that cleaning surfaces can reduce microbe concentration by 90-99.9 % depending on the cleaning agent and the technique used (87). It should be noted that disinfectant solutions can become contaminated during cleaning and progressively reduce their effectiveness.

To this end, the WHO recommends discarding used detergent or disinfecting solution in areas with high risk (88). Therefore, hand hygiene and surface disinfection are effective strategies in blocking the transmission of COVID-19 disease in the population and slowing down the spread of the virus.

3. MATERIAL AND METHOD

3.1. Place of study

The study was conducted at seven public universities in Ankara, the capital of Turkey. With an international student population of about 13,400, Ankara has the highest population of international students in Turkey after Istanbul. Data of this study was obtained from international students studying at Ankara University, Ankara University of Social Sciences, Gazi University, Hacettepe University, Haci Bayram Veli University, Middle East Technical University, and Yıldırım Beyazıt University.

Ankara University was established in the year 1946. The Rectorate building, Faculties of Arts and Sciences, Engineering, and Pharmacy are located on Tandoğan Campus, the largest campus of the university. Faculty of Law, Political Sciences, Education and Communication are located in Cebeci Campus, Faculty of Language, History, and Geography are in Sıhhiye, Faculty of Medicine is in Cebeci, Faculty of Veterinary Medicine and Agriculture is in Dışkapı. The University had 4,191 academic staff, 7,333 other staff, and 66,809 students including 3,673 international students (5.5% of total students) in the 2019-2020 academic year. Türkiye Scholarship Program supports 595 international students who are studying in undergraduate and graduate programs at the University.

Ankara Social Sciences University was established in 2013. 520 students in the University are enrolled in four Faculties (Foreign Languages, Political Sciences, Social Sciences, and Law) and seven Institutes. The university has 25 academic and 53 administrative staff. 40 international students enrolled in the academic year 2018-2019. Türkiye Scholarship Program, Ankara University studying Social Sciences 33 offers scholarships to international students.

The first building of Gazi University was established in 1926 under the name of “Middle School and Education Institute.” Later, in 1976, the name was changed to Gazi Education Institute and Gazi University in 1985. The central building of the university is located in the Beşevler district. There are 10 faculties (Architecture, Applied Sciences,

Dentistry, Education, Engineering, Health Sciences, Pharmacy, Medicine, Sports Sciences, and Technology), 5 Institutes, and 3 Vocational Schools. 40,053 students are studying at the university. Out of the total students, 940 (2.3%) are international students. Türkiye scholarship Program offers scholarships to 335 international students at Gazi University.

Hacettepe University was established in 1967. The university has 15 Faculties, 15 Institutes, 4 Vocational Schools, and 93 Research Centers. Faculties of Dentistry, Pharmacy, Health Sciences, Medicine, Nursing, Physical Therapy, and Rehabilitation are located in Sıhhiye Campus. Faculties of Education, Science, Law, Engineering, Economics and Administrative Sciences, Communication, Sports and Fine Arts are located in Beytepe Campus. About 50,000 students are studying in 97 undergraduate, 270 graduate, and 238 doctoral programs at the university. There are 2,100 international students (4.2% of total students) from 120 countries. The university has 1,806 faculty members, 635 lecturers, 1,515 research assistants, and 7,735 administrative staff. Türkiye Scholarship Program offers scholarships to 295 international students studying at Hacettepe University.

Hacı Bayram Veli University was established in 2018. The university has 214 female and 277 male students. This university is located in Çankaya District. The University consists of 9 Faculties (Literature, Fine Arts, Law, Economic and Administrative Sciences, Communication, Islamic Sciences, Polatlı Science-Literature, Art and Design, and Tourism), 3 Vocational Schools, 30 Research Centers, and 1 Institute. This university has 323 international students registered in undergraduate and postgraduate programs who receive a full scholarship from the Türkiye Scholarship Program.

Middle East Technical University was established in 1956. 26,784 students are studying in 41 undergraduate, 108 graduate, and 69 doctoral programs at the university. Out of the total number of students enrolled in these programs, 1,332 (5.0%) are international students. The university has 791 lecturers, 225 lecturers, and 1,273 research assistants. Türkiye Scholarship Program offers scholarships to 48 international students studying at Middle East Technical University.

Yıldırım Beyazıt University was established in 2010. The University is located in Esenboğa, Bilkent, Etlik, Cinnah, Keçiören, Çubuk Campuses, Etlik National building, Etlik 15 July Martyrs Building and Documentation Center Building. The university offers undergraduate education in the fields of Dentistry, Law, Humanities and Social Sciences, Islamic Sciences, Management, Engineering, and Natural Sciences, Architecture, Health Sciences, Fine Arts, Political Sciences, Turkish Music, Medicine, and vocational schools. In the 2018-2019 academic year, the university has 6,032 students. Out of these students, 346 are international students. There is 1,100 academic staff at the university. Türkiye Scholarship Program offers scholarships to 273 international students enrolled in undergraduate and postgraduate courses in Yıldırım Beyazıt University.

3.2. Time of study

The study was conducted from September 2020 to June 2021.

3.3. Study design

The study is a descriptive cross-sectional epidemiological study.

3.4. Study population

The study population consisted of international students who were at least 18 years of age and had been staying in Turkey in the past one year, sponsored by the Türkiye Scholarship Program, and enrolled in public universities in Ankara province.

3.5. Sampling

No sample was selected; the study was aimed to reach all the international students who formed the study population.

3.6. Inclusion and exclusion criteria

3.6.1. Inclusion criteria

- International students aged 18 years and above.
- Enrolled in undergraduate or postgraduate programs in universities in Ankara.
- Living in Turkey during October 2020-March 2021 period.

3.6.2. Exclusion criteria

- International students holding non-resident student visas.
- Those who permanently reside in Turkey.

3.7. Terms, classification, and criteria

International student – Is an individual who is not a resident of the country of his/her study. (UNESCO)

Coronavirus disease 2019 –Is a respiratory infectious disease, which presents with symptoms ranging from mild or moderate respiratory illness to serious illnesses, especially in older persons and those with co-morbidities. (WHO)

Upper respiratory tract infection (URTI) –Acute infections of the nose, throat, larynx, pharynx, trachea, and sinuses, which presents with a wide range of symptoms. (CDC)

Influenza-like illness (ILI) –Acute respiratory infection characterızed wıth fever of greater than 38 degree Celcius and cough without an alternative causative agent. (WHO)

Flu season –Is an annual period with the occurrence of influenza outbreaks. In Turkey, it typically occurs from October to May. (MoH, Turkey)

Personal protective measures (PPM) –These are a set of measures that include hand hygiene, physical distancing, facemasks, surface disinfection, respiratory etiquette, and avoiding touching eyes, nose, or mouth to protect an individual from COVID-19 infection. (WHO)

Facemasks –Refers to the protective covering of the face and mouth or entire face that primarily reduces transmission of droplets. (WHO)

Hand hygiene –refers to actions with the aim of hand antisepsis to reduce the microorganisms on the surface of the hands. (WHO)

Physical distancing –Refers to keeping a distance of 1.5 meters between a person and the members who are not his/her household in both indoor and outdoor spaces (CDC).

3.8. Data collection tools

We used a semi-structured questionnaire to collect data. Participants gave a self-reported assessment. The survey questionnaire comprised of questions about participants' sociodemographic characteristics, health status, and personal protective measures against COVID-19. Sociodemographic information included age, country of citizenship, gender, and place of residence. Health status information regarded current smoking, chronic disease, and symptoms of ILIs (persistent cough, fever, runny and stuffy nose, and sore throat). Information on personal protection during the coronavirus pandemic included questions on the frequency of wearing facemasks when in public places, social distancing, hand hygiene, and surface disinfection. Questions on the level of personal protective measures against COVID-19 disease were in a Likert scale format. Demographic attributes, health status, and level of personal protective measures were considered as independent variables whereas symptoms of upper respiratory tract infection was considered as the dependent variable. The upper respiratory tract infection

variable was defined as a discrete variable with two categories (i.e. presence or absence of symptoms).

We prepared the survey questions in multiple-choice or short answer question types. Participants took approximately ten minutes to fill the questionnaire. We included the participant consent form at the beginning of the survey form. We did not collect information that identified the participants. All responses were anonymous. After reading the consent form, participants clicked a link that directed them to the survey questions, thereby giving an informed consent to participate in this study. The follow-up questionnaire comprised of questions about participants' place of residence and symptoms of upper respiratory infection (persistent cough, fever, runny and stuffy nose, and sore throat) including the month and week when the symptoms first began, and how long the symptoms lasted.

3.9. Pretest of the questionnaire

We conducted a pretest of the questionnaire on 100 students (male: female ratio of 1) to ensure that questions were correctly interpreted. We received participants' responses about the time take to complete the survey as well as their suggestions for improvements. The survey instrument used in the current study was validated and the scale reliability was examined because it had not been validated previously in the context of this research. Cronbach's alpha test was calculated for all participants. Results indicated that the scale had good reliability (α=0.81, 95% CI 0.79-0.83).

Table 3.1. Cronbach's alpha for indicators of personal protective measure

Indicator	Alpha
Facemask	0.81
Social distancing	0.77
Hand hygiene	0.78
Surface disinfection	0.76
Avoiding crowded places	0.78
Respiratory etiquette	0.76
Overall	0.81

3.10. Data collection

This study investigated the implementation of measures protecting from COVID-19 among international students studying in the city of Ankara, and the impact of these measures on the incidence of influenza-like illnesses. The primary research questions that guided the study were divided into two. The first question addressed whether international students' socioeconomic status and demographic factors affected their implementation of the personal COVID-19 measures recommended by the WHO. The second research question was divided into two: a) Was there a change in the frequency of influenza-like illnesses reported by international students during the 2020-2021 flu season? and b) Was there a relationship between the practice of personal COVID-19 measures and the reported cases of influenza-like illnesses among international students? To address these questions, we enrolled 758 international students studying in Turkey in this study and observed them using online surveys.

Data collection commenced at the end of October 2020 and concluded at the end of March 2021. Since the research was conducted during the coronavirus pandemic, the data was collected online to minimize the risks of infection. The questionnaire was delivered to study participants electronically through Google forms. The questionnaire

was sent to the enrolled participants through their student information system. After the questionnaire was reviewed and approved, it was forwarded to the Türkiye Scholarship Program's Information Department and uploaded to students through the Türkiye Scholarship Information System. The survey questionnaire was sent on October 2020. Subsequent follow-up questionnaires were in December 2021 and March 2021. A reminder was sent to international students in the middle of every month through email to maximize the response rate.

A total of 847 international students completed the survey. Potential participants were screened based on the responses given in the baseline questionnaire to determine whether they met the study's inclusion criteria. Of the students who filled the survey, 79 were excluded from the study because they were not residing in Turkey at the time of the study. An additional 10 students were excluded from the study because they reported being permanent residents in Turkey, thus, did not meet the UNESCO definition of an international student. Therefore, we followed 758 students using follow-up surveys sent in December 2020 and March 2021. We assigned a unique random to the students that allowed us to track at the same time maintain the anonymity of their responses. All the enrolled participants were followed to the end of the study; There was no loss to follow-up (censoring).

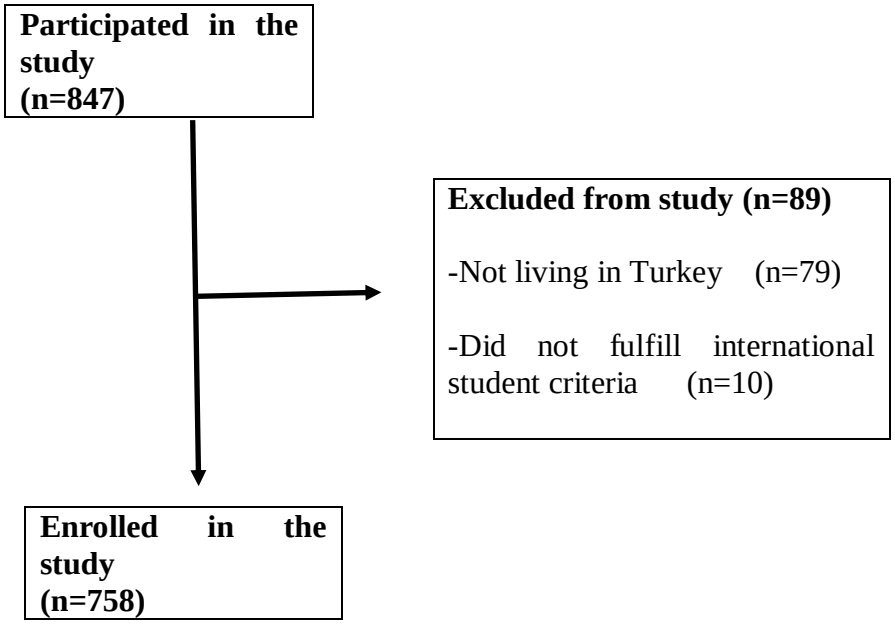


Figure 3.1. Participant enrollment

Table 3.2. Number of students who participated in the study and were followed from December 2020 to March 2021

N	October 2020		
	Male	Female	Total
	442	442	847
	December 2020		
	Male	Female	Total
	383	375	758
	March 2021		
	Male	Female	Total
	383	375	758

3.11. Study personnel

The researcher collected the study data electronically. Furthermore, the researcher analyzed the data and prepared the research report under supervision.

3.12. Variables

3.12.1. Sociodemographic characteristics

Regarding sociodemographic attributes and health status, participants reported their age, gender, country of citizenship, country of residence (Turkey/others), place of residence (dormitory/apartment), current smoking (yes/no), and history of chronic disease (yes/no).

3.12.2. Personal protective measures

Regarding the practice of COVID-19 measures recommended by the WHO, participants gave an assessment of their frequency of wearing a facemask in public spaces or when around others, social distancing, hand hygiene, disinfecting surfaces, avoiding to touch eyes, nose or mouth, and avoiding crowded places using a 5-point Likert scale.

3.12.3. Symptoms of influenza-like illnesses according to WHO

Participants reported whether they experienced fever, nasal blockage or runny nose, sore throat, persistent cough, and body aches in the last month. Participants who experienced these symptoms reported how long the symptoms lasted. A participant was regarded to haves symptoms of influenza-like illness when they reported to have the aforementioned symptoms, which resolved within two weeks and did not receive any confirmation test for an alternative cause.

3.13. Statistical analysis

We performed all statistical analyses with R statistics version 4.3.3. We calculated the measures of central tendency and variability of continuous variables, and used cross-tabulations to compare categorical variables. We dichotomized responses to the frequency of wearing facemasks, washing hands, physical distancing, avoiding crowded places, disinfecting surfaces, and avoiding touching the face as 1(Frequently or Sometimes) and 0 (Never). All participants to some extent implemented some of the measures to protect themselves from coronavirus infection. We dichotomized the students' overall implementation of COVID-19 measures as 1 (Below median) and 2 (Above median). We compared frequency of practicing personal protective measures among students who had influenza-like illnesses with those who did not have influenza-like illnesses. The participants' level of personal protection against COVID-19 was calculated based on their frequency of masking, handwashing, and social distancing.

Kaplan-Meier analysis was used to estimate the first occurrence (cumulative incidence) of symptoms of influenza-like illnesses (outcome) over the 2020-2021 flu season (time). Kaplan Meier estimate is a reliable method used to assess whether an intervention is effective by examining development of disease or survival over a given period after the introduction of the intervention (89). It is commonly used in clinical trials and community intervention studies to measure the effectiveness of a drug or an intervention. This analysis allows computing of survival over time and factors censoring events such as lost to follow-up. Kaplan-Meier analysis has also been used in observational studies where subjects are observed over a given period because it gives details of the changes of the survival function during follow-up (90, 91). In addition, it allows comparisons to be made between observed groups. We used Kaplan-Meier analysis in this study to assess whether the implementation of personal measures recommended by the WHO to protect against COVID-19 prevented transmission of ILIs among international students. We used this method because it accounted for loss to follow-up (censoring), allowed assessment of the effectiveness of personal protective

measures, and allowed us to compare frequency of ILIs over time between students who adhered and those who did not adhere to the personal protective measures.

Prior to conducting survival analysis, we conducted Levene's F-test to test the homogeneity of variances, and found that the variances were homogeneous ($F=1.43$, $p=0.49$). Since all the study participants implemented personal protective measures to some level, there was no control group. Therefore, we divided the participants into two groups based on their PPMS using the median value as the cutoff. We then conducted a survival analysis with the event of interest determined as experiencing symptoms of ILIs or censoring over a six-month period of observation.

We used Cox proportional hazard regression to estimate relationships between personal protective measures against COVID-19 and the absence of symptoms of influenza-like illnesses during the 2020-2021 flu season. The Cox proportional hazard regression analysis is used to simultaneous evaluate the effect of covariates on survival (91). It allows investigators to make associations between several factors and event of interest, and to examine how a factor influenced the event of interest at a specific point in time. We used Cox proportional hazard regression in the present study to evaluate associations between implementation of personal protective measures and cases of ILIs among international students. We use this regression analysis because it allowed us to evaluate the influence of implementing a specific measure in preventing ILIs at a specific point it time.

3.14. Ethics Statement

- We obtained ethical approval to conduct this study from the Non-Interventional Clinical Research Ethics Committee of Hacettepe University (Appendix 1)
- Ministry of Health of Turkey approved this study (Appendix 2).
- The Presidency of Türkiye Scholarship gave approval to recruit international students in this study.
- All international students in the current study gave an informed consent to participate.

4. RESULTS

4.1. Demographic characteristics and health status of participants

The final number of participants enrolled in the study included 758 undergraduate and postgraduate students from 95 countries (Table 4.1). The proportion of study participants with regard to age, gender, and country of origin approximated the proportion of international students in Turkey. According to statistics from the Council of higher education (Turkey), as of the fall semester of the 2020-2021 academic year, the highest population of international students in Turkey were from Azerbaijan, Syria, and Afghanistan. The majority of participants in this study came from Asian (48.7%, n=369), African (40.3%, n=305), and European (11.2%, n=77) countries (Table 4.1). The largest national groups in Asia were Syria (39 students), Afghanistan (31 students), Indonesia (31 students), and Azerbaijan (29 students). The largest national groups from Africa included Kenya (37 students), Egypt (20 students), Tunisia (19 students), Ethiopia (17 students), and Sudan (17 students). In Europe, the largest national groups were from Greece (14 students), Kosovo (11 students), and North Macedonia (10 students).

Table 4.1. Participants enrolled in the study in Ankara during the October 2020 – March 2021 period by country of origin (n=758)

Country	n	%
Africa		
Algeria	15	2.00
Angola	1	0.13
Benin	15	2.00
Burkina Faso	3	0.40
Burundi	4	0.53
Cameroon	11	1.45
Central African Republic (CAR)	1	0.13

Chad	11	1.45
Comoros	6	0.79
Congo, Democratic Republic of the	2	0.26
Congo, Republic of the	3	0.40
Cote d'Ivoire	3	0.40
Djibouti	1	0.13
Egypt	20	2.64
Eritrea	1	0.13
Eswatini	1	0.13
Ethiopia	17	2.24
Gabon	1	0.13
Gambia	3	0.40
Ghana	10	1.32
Guinea	5	0.66
Kenya	37	4.88
Madagascar	4	0.53
Mali	6	0.79
Mauritania	3	0.40
Morocco	11	1.45
Mozambique	5	0.66
Niger	8	1.06
Nigeria	9	1.19
Rwanda	13	1.72
Sierra Leone	1	0.13
Somalia	13	1.72
South Sudan	4	0.53
Sudan	17	2.24
Tanzania	5	0.65
Tunisia	19	2.5
Uganda	10	1.32

Zambia	2	0.26
Zimbabwe	4	0.53
	n=305	40.28
Asia		
Afghanistan	31	4.09
Azerbaijan	29	3.83
Bangladesh	8	1.06
Brunei	1	0.13
China	7	0.92
Cyprus	1	0.13
Georgia	8	1.06
India	7	0.92
Indonesia	31	4.09
Iran	23	3.03
Iraq	24	3.17
Israel	4	0.53
Japan	1	0.13
Jordan	11	1.45
Kazakhstan	23	3.03
Kyrgyzstan	7	0.92
Lebanon	3	0.40
Malaysia	11	1.45
Mongolia	11	1.45
Myanmar	2	0.26
Nepal	1	0.13
Pakistan	8	1.06
Palestine	21	2.77
Philippines	2	0.26
Russia	7	0.92
Sri Lanka	1	0.13

Syria	39	5.15
Taiwan	3	0.40
Tajikistan	1	0.13
Thailand	3	0.40
Turkmenistan	7	0.92
United Arab Emirates (UAE)	2	0.26
Uzbekistan	9	1.19
Vietnam	4	0.53
Yemen	18	2.37
	n= 369	48.67
Europe		
Albania	4	0.53
Bosnia and Herzegovina	6	0.79
Bulgaria	3	0.40
Cyprus	1	0.13
Germany	1	0.13
Greece	14	1.85
Hungary	1	0.13
Italy	2	0.26
Kosovo	11	1.45
Moldova	3	0.40
Montenegro	5	0.66
North Macedonia	10	1.32
Romania	1	0.13
Serbia	5	0.66
Spain	2	0.26
Ukraine	8	1.06
	n=77	10.16
North America		
Haiti	2	0.26

	n=2	0.26
South America		
Brazil	1	0.13
Ecuador	1	0.13
Colombia	1	0.13
Venezuela	2	0.26
	n=5	0.66
Total enrolled participants	N=758	100.00

Participants' age ranged from 18 to 40 years (M=26, SD=5) and gave information on covariates including age, gender, country of origin, smoking status, and place of residence. See Table 4.2 for a breakdown of some of the demographic and health characteristics of the study participants. About half of the participants were living in either state-run, private or university dormitories and the other half were living in an apartment or a house. Of the study participants, 4.2% (n=32) had a chronic disease. The mean age of participants with chronic disease was 28 years while the mean age of those without chronic disease was 25 years (p=0.004). About 10.3 % (n=78) of international students reported being current smokers. The number of male students who reported to currently smoke cigarettes was higher than female students (p=0.003).

Table 4.2. Demographic characteristics of study population in Ankara during the October 2020 –March 2021 period

Characteristic	Male (n=383)		Female (n=365)		Total (n=758)	
	N	%	N	%	N	%
Age						
≤ 20	65	17.0	64	17.1	129	17.0
21-25	120	31.3	160	42.7	280	36.9
26-30	114	29.8	102	27.2	216	28.5
31-35	70	18.3	38	10.2	108	14.2
36-40	14	3.7	11	2.9	25	3.3
Country						
Asia	178	46.5	191	50.9	369	48.7
Africa	182	47.5	123	32.8	305	40.3
Europe	22	5.7	55	14.7	77	10.1
North and South America	1	0.3	6	1.6	7	0.9
Residence						
Apartment / House	198	51.7	174	46.4	372	49.1
Dormitory	185	48.3	201	53.6	386	50.9
Chronic disease						
Yes	13	3.4	19	5.1	32	4.2
No	370	96.6	356	94.9	726	95.8
Smoking						
Yes	52	13.6	26	6.9	78	10.3
No	331	86.4	349	93.1	680	89.7

Percentages were calculated from responses to each question.

A total of 154 participants (20.3%) reported experiencing symptoms of ILIs including a persistent cough, fever, stuffy nose, pharyngitis, and body aches between October 2019 and March 2020 (Table 4.3). With regard to gender, no significant difference was observed among those who reported experiencing symptoms of ILIs. Between October 2020 and March 2021, a total of 139 participants (18.34%) reported experiencing symptoms including a persistent cough, fever or chills, sore throat, stuffy nose. As illustrated in Table 4.3, reported cases of ILIs during the 2020-2021 flu season among international students were lower compared to the 2019-2020 flu season. As observed from students' reports of the previous ILI symptoms, no significant difference was observed between those who experienced symptoms of ILIs by gender.

Table 4.3. Reported cases of influenza-like illnesses among international students in Ankara during 2019-2020 and 2020-2021 flu seasons.

	Symptoms of ILIs					
	2020-2021 flu season					
2019-2020 flu season	Present	%	Absent	%	Total	%
Present	25	18.0	129	20.8	154	20.3
Absent	114	82.0	490	79.2	604	76.7
Total	139	100.0	619	100.0	758	100.0

Mcnemar test was used to calculate the difference between the cases of influenza-like illnesses reported by participants for the 2019-2020 and the 2020-2021 flu seasons. ($\chi 2 = 0.807$, df = 1, p-value== 0.369)

See Table 4.4 on the breakdown of international students who reported experiencing symptoms of ILIs from October 2020 to March 2021. As illustrated in the table, most cases of ILIs occurred during the month of December 2020.

Table 4.4. Frequency of influenza-like illnesses among study participants in Ankara between October 2020 and March 2021

2020-2021	Frequency	Percent (%)
October	11	7.9
November	15	10.8
December	75	54.0
January	20	14.4
February	11	7.9
March	7	5.0
Total	139	100.0

The highest cases of reported influenza-like illnesses among participants occurred in the month of December 2020.

More than half of reported cases of ILIs (54.0%) occurred in the month of December 2020. The least reported cases of ILIs occurred in the month of March 2021 (5.0%).

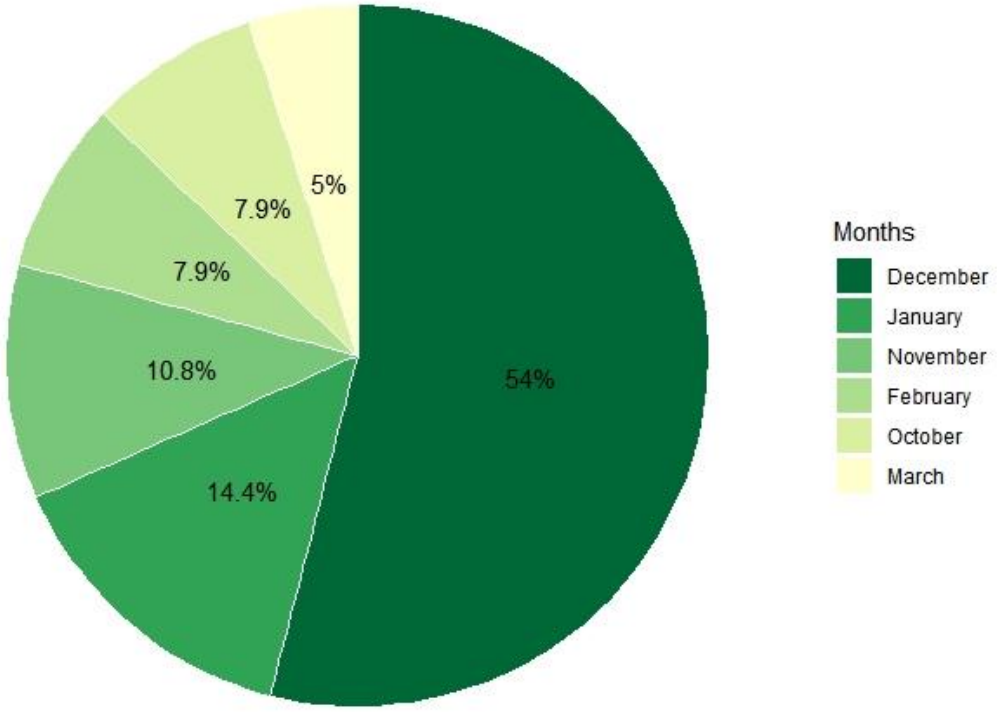


Figure 4.1. The percentage of participants who reported symptoms of influenza-like illnesses between October 2020 and March 2021

4.2. Implementation of personal measures against COVID-19

The international students' level of personal measures against COVID-19 was assessed using five items, which included the frequency of wearing facemasks, physical distancing, hand hygiene, surface disinfection, and avoiding crowded places. The international students reported their frequency of implementing these measures using a 3-Likert scale (2. "Always," 1. "Sometimes," or 0. "Never"). The scale reliability was examined because it had not been validated previously in the context of this research. Cronbach's alpha test was calculated for all participants. Results indicated that the scale had good reliability (α=0.81, 95% CI 0.79-0.83).

The participants' status of implementing COVID-19 measures is reported in Table 4.5. It can be seen that participants who did not experience symptoms of ILIs reported higher implementation of all the personal protective measures compared to participants who experienced symptoms of ILIs. In particular, 98.5% (n=610) of international students without symptoms of ILIs reported always wearing a facemask when in crowded places or when around others compared to 95.75% (n=133) of students who reported experiencing symptoms of ILIs. It should be noted that during the study, wearing facemasks at public places was mandatory in Turkey and this could have resulted in the high implementation of facemasks among both students who reported experiencing symptoms of ILIs and those who reported not experiencing the symptoms between October 2020 and March 2021.

With regard to social distancing, 87.1% (n=539) of students who did not experience symptoms of ILIs reported to always observe a distance of at least 1.5m when around others compared to 59.7% (n=83) of students who experienced the symptoms. As observed, there was a large difference in implementing physical distancing measures between the two groups. Unlike wearing facemasks, social distancing measures are not mandatory. However, implementation of physical distancing was highly recommended by the WHO and the Ministry of Health of Turkey as a measure to prevent transmission and protect against COVID-19 disease. Therefore, it

was observed that the overall implementation of physical distancing was lower compare to wearing facemasks, especially among international students who reported experiencing symptoms of ILIs.

Furthermore, 565 students (91.3%) in the group of international students without any symptoms of ILIs reported to always disinfect their hands after visiting crowded places compared to 114 students (82.0%) in the group that experienced ILIs. Similarly, 70.4 % (n=436) of students who did not experience symptoms of ILIs reported frequently disinfect surfaces before touching them, especially in crowded places while 59.0 % (n=82) of students who showed the symptoms reported frequently disinfect surfaces. When it comes to avoiding crowded places, 83.5 % (n=517) of students who did not report any symptoms of ILIs always/frequently avoided visiting crowded places compared to 63.3% (n=88) of students who reported experiencing the symptoms. The last measure assessed was cough etiquette, which was defined in this research context as covering one's mouth when coughing and disinfecting the hands after coughing. While 82.9 %(n=519) of students without symptoms of ILIs reported to always/frequently exercise cough etiquette, 72.7% (n=101) of students who experienced the symptoms of ILI reported to always/frequently exercise cough etiquette. Cough etiquette was not included in the scale assessing the overall implementation of personal protective measures since its primary function overlaps with wearing facemasks (92). Figure 4.1 illustrates the overall implementation of the measures against COVID-19 by all the participants in the study. It can be seen that overall, the implementation status among international students was high. For example, almost all participants reported wearing facemasks when in crowded places and while around others.

Figure 4.2 shows the cumulative frequency of personal protective measure score (PPMS) for the group of students who reported have symptoms of ILIs and the group that did not report any symptoms of ILIs. PPMS was calculated from students' frequency of implementing measures against COVID-19 including wearing facemasks, social distancing, hand hygiene, surface disinfection, and avoiding crowded places. We assigned scores of 2, 1, and 0 to students who always/frequently, sometimes, and never implemented a specific measure to protect against COVID-19. We then calculated the

PPMS by adding the sum of the scores for each of the five measures. The highest score PPMS was 10 and the lowest score was 0. It can be seen from the cumulative frequency curve that the PPMS for students who did not experience symptoms of ILIs was higher compared to students who reported experiencing the symptoms between October 2020 and March 2021, further indicating that these students adhered more to the personal protective measures.

Table 4.5. The percentage of participants in Ankara for each frequency of personal measure recommended by WHO during the October 2020 to March 2021 period

	N	0. Never		1. Sometimes		2. Always	
		N	%	N	%	N	%
Participants with influenza-like illnesses							
Facemask	139	-	-	6	4.3	133	95.7
Physical distancing	139	-	-	56	40.3	83	59.7
Hand hygiene	139	5	3.6	20	14.4	114	82.0
Surface disinfection	139	14	10.1	43	30.9	82	59.0
Avoiding crowed places	139	3	2.2	48	34.5	88	63.3
Respiratory etiquette	139	10	7.2	28	20.3	101	72.7
Participants without influenza-like illnesses							
Facemask	619	1	0.2	8	1.3	610	98.5
Physical distancing	619	8	1.3	72	11.6	539	87.1
Hand hygiene	619	8	1.3	46	7.4	565	91.3
Surface disinfection	619	18	2.9	165	26.7	436	70.4
Avoiding crowed places	619	10	1.6	92	14.9	517	83.5
Respiratory etiquette	619	5	0.8	101	16.3	513	82.9

Percentages were calculated from responses to each of the questions.

Facemask was the most implemented and surface disinfection was the least implemented personal protective measure among study participants. Overall, the implementation of the personal protective measures against COVID-19 among international students in Turkey during the 2020-2021 flu season was high.

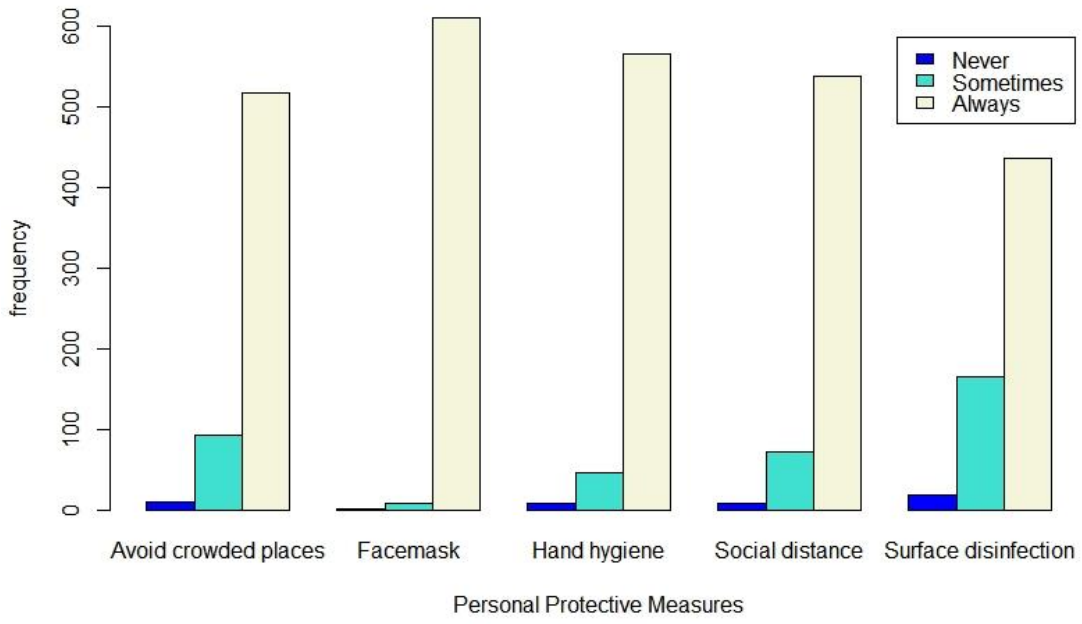


Figure 4.2. Implementation of personal measures recommended by WHO to protect against COVID-19.

The personal protective measure score was calculated from participants' frequency of wearing facemasks, social distancing, hand hygiene, surface disinfection, and avoiding crowded places. Participants who did not report any symptoms of ILIs had higher personal protective measure score than those who reported the symptoms, which suggested that implementation of measures recommended by WHO protected people from ILIs during the 2020-2021 flu season.

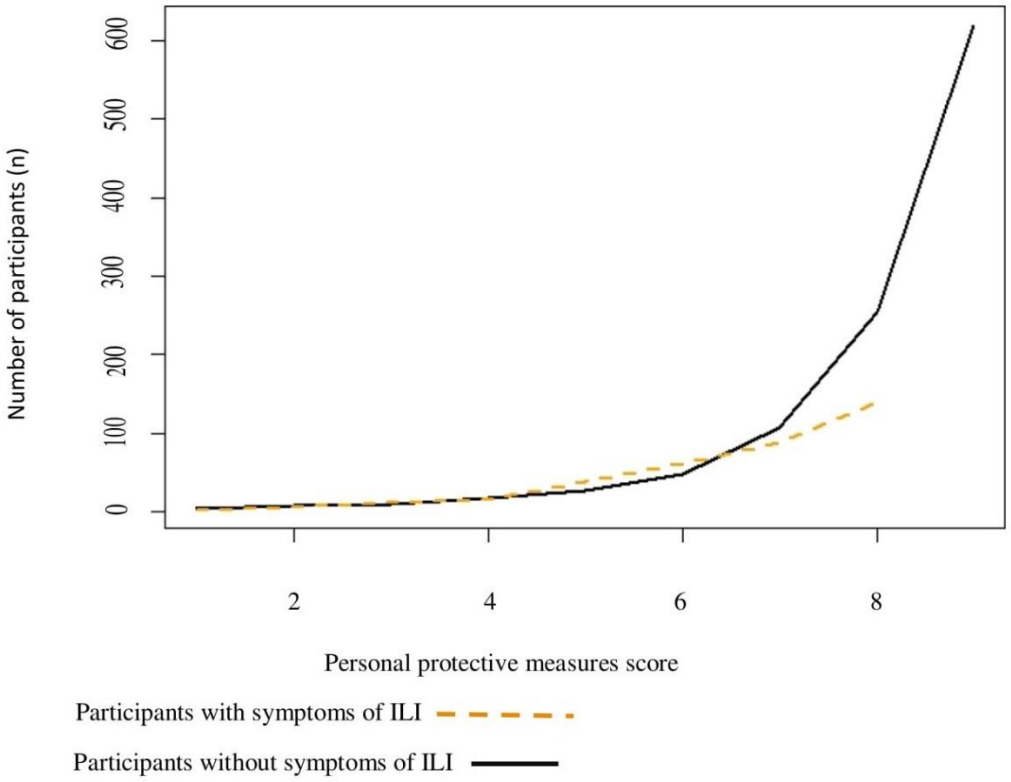


Figure 4.3. Cumulative frequency of personal protective measure score (PPMS) among students with symptoms and without symptoms of influenza-like illnesses.

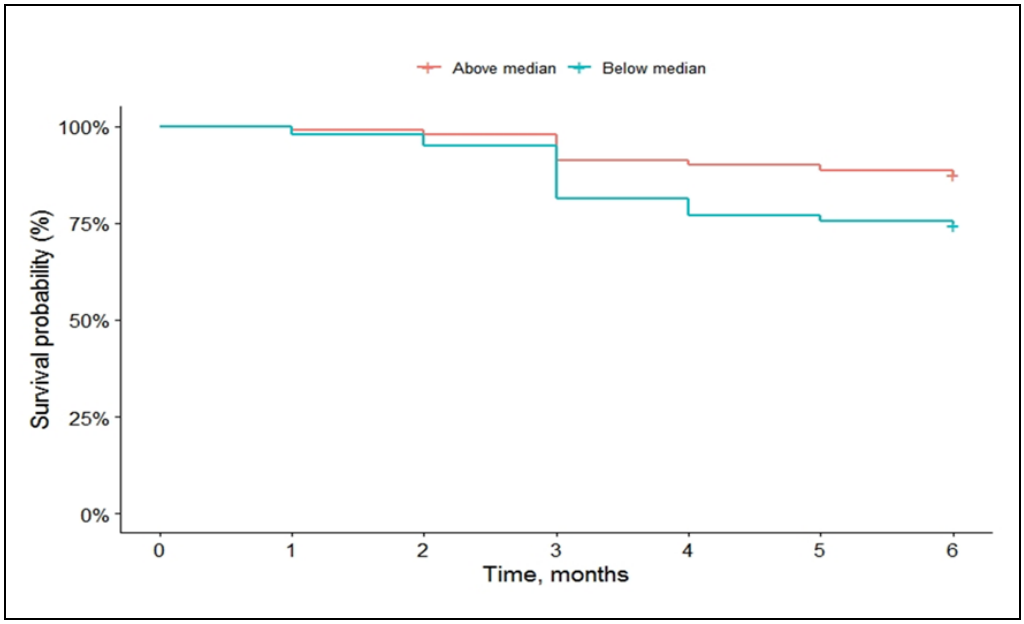
4.3. Kaplan-Meier Analysis

Among 758 international students included in the analysis, 139 students (18.34%) reported symptoms of ILIs; a total of 87 students had scores below the median, and 52 had scores above the median personal protective measure. Table 4.6 and Figure 5.3 show the results of Kaplan-Meier survival. It can be seen from the Kaplan-Meier curve that the overall probability of being event-free among students with PPMS above the median was higher compared to students with a score below the median (Figure 4A). Similarly, the cumulative hazard curve (Figure 4B) illustrates that 25.5% of participants who scored below median reported symptoms of ILIs while 12.5 % of participants who scored above the median reported symptoms of ILIs. Therefore, the results from the Kaplan Meier method showed that international students who adhered to implementing the personal protective measures recommended by the WHO had a reduced risk of acquiring respiratory infections.

Table 4.6. Survival table for students with personal protective measure below and above median score

Time	Number at risk	Number of events (ILIs)	Proportion of participants that did not have an event (ILIs)	95 %CI Lower	Upper
> median					
October	417	4	0.990	0.981	1.000
November	413	5	0.978	0.965	0.992
December	408	28	0.911	0.884	0.939
January	380	5	0.899	0.871	0.929
February	375	6	0.885	0.855	0.916
March	369	4	0.875	0.844	0.908
< median					
October	341	7	0.979	0.965	0.995
November	334	10	0.950	0.927	0.974
December	324	47	0.812	0.772	0.855
January	277	15	0.768	0.725	0.814
February	262	5	0.754	0.709	0.801
March	257	3	0.745	0.700	0.793

The overall six-month survival of participants who scored above the median PPMS was 87.5% and for below the median PPMS was 74.5%. The highest reported cases of influenza-like illnesses among participants occurred in December.



A

B

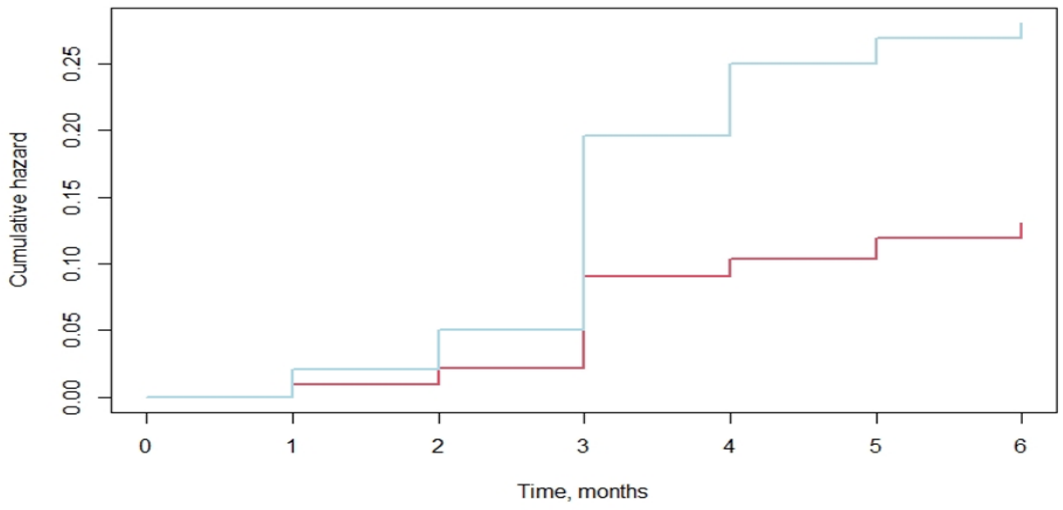


Figure 4.4. A Survival probability of students with personal protective measures above the median (red) and below the median (blue) score. **B** Cumulative hazard plot of students with personal protective measures above the median (red) and below the median (blue) score.

4.4. Cox proportional hazard regression analysis

To clarify the personal measures against COVID-19 that offered more protection to the participants from experiencing symptoms of influenza-like illnesses, we conducted a cox proportional hazard regression analysis, factoring censoring and the time of observation. The first regression analysis included covariates (i.e. gender, age, country of origin, current smoking) in addition to the implementation of the personal COVID-19 measures. The initial results showed that gender (p=0.71), age (p=0.59), country of origin (p=0.65), and smoking (p=0.26) did not significantly affect the symptoms of influenza-like illnesses. Therefore, the covariates were removed from the cox-proportional regression model. Afterward, the analysis was rerun only with the five personal against COVID-19 set as the covariates.

Table 4.7 provides the results of the Cox proportional regression analysis. In the multivariate regression analysis, we found a significant association between the implementation of some of the personal protective measures and reported symptoms of influenza-like illnesses. The analysis showed that at a given point in time, students who wore facemasks were 33.6% less likely to show symptoms of influenza-like illnesses than students who did not wear facemask adjusting for all the other personal protective measures (Hazard Ratio=0.664, 95%CI=0.494 - 0.893, p=0.006). Similarly, students who exercised social distancing measures were 23.5% less likely to report symptoms of influenza-like illnesses when compared to those who did not adhere to social distancing adjusting for the other measures (Hazard ratio= 0.765, 95%CI=0.610 - 0.960, p=0.020). Furthermore, international students who frequently disinfected their hands were 17.1 % less likely to report symptoms of influenza-like illnesses than those who did not frequently disinfect their hands (Hazard ratio=0.821, 95%CI=0.793 - 0.915, p=0.029). There was no significant association between surface disinfection (p=0.298) and avoiding crowded places (0.730) with the reported symptoms of influenza-like illnesses among the participants.

Table 4.7. Associations between personal measures against COVID-19 and the symptoms of influenza-like illnesses

Covariates	Hazard ratio (HR)	95%CI of HR	p-value
Facemask	0.664	0.494 - 0.893	0.006*
Physical distancing	0.765	0.610 - 0.960	0.020*
Hand hygiene	0.829	0.793 - 0.915	0.029*
Surface disinfection	0.895	0.724 - 1.104	0.298
Avoiding crowded places	0.964	0.781 - 1.189	0.730

*shown is the p value <0.05, which indicated a significant relationship. The analysis included all 758 international students.

5. DISCUSSION

This descriptive epidemiological study investigated the practice of measures against COVID-19 among international students in Turkey, focusing on the role of these measures in preventing transmission of respiratory infections. The population of international students is increasing globally, as well as in Turkey. Like in many different countries, international students in Turkey face the challenge of looking after their health while living away from their families. Therefore, this study investigated the implementation of COVID-19 measures by international students during the coronavirus pandemic in an attempt to improve their healthcare, which is essential for them to complete their education successfully. Furthermore, this study sort to understand the role of these measures in preventing the transmission of respiratory infections among international students. Understanding the role of COVID-19 measures recommended by WHO in protecting against acute respiratory infection can benefit international students and healthcare providers alike by preventing morbidity and mortality caused by respiratory infections. It can also inform policymakers to formulate the right non-pharmaceutical interventions to control the spread of epidemics caused by respiratory infections.

5.1. Implementation of personal protective measures

We were interested to find out whether international students' sociodemographic characteristics affected their implementation of personal measures against COVID-19. Previous studies have shown that men and people with a low-income level had lower implementation the measures against COVID-19 (15, 94) in the course of the coronavirus pandemic. In the present study, however, there was no relationship between international students' economic status and their implementation of measures protecting from coronavirus infection. All participants in the study were on scholarship, causing a potential lack of association between the economic level of participants and implementation status of personal measures against COVID-19. A study conducted by

Masai and colleagues revealed similar findings where the economic status of international students on scholarship did not affect their healthcare access (95).

Although there were no significant differences in most demographic and health status of students by gender, more female students reported higher compliance of the personal protective measures compared to males students ($p<0.001$). This finding was consistent with previous evidence, which showed that men adopted the COVID-19 measures more slowly compared to women (15, 96). Also, the number of male students (13.6%, n=52) who reported to be current smokers was significantly higher compared to female students (6.9%, n=26). Howbeit, the prevalence of current smoking among international students was lower when compared to that of the local population. Studies have shown that the smoking prevalence of the local population is 30.5 % with 46. 1 % of the men and 15.7% of the women reported as smokers (97). In the present study, 10.3% of international students reported being current smokers. Findings from the present study showed that students who did not smoke implemented the facemasks more compare to students who were smokers ($p<0.001$). Adherence to facemask by individuals who smoke presents challenges since an individual has to remove facemask to smoke.

International students' age did not affect their implementation of the personal measures against COVID-19. Previous studies have shown that the adherence to measures protecting from COVID-19 was significantly higher among older adults (15, 98). It noteworthy to mention that the participants in this study were undergraduate and postgraduate students with a mean age was 26 years (minimum age 18 years and maximum age 40 years). There were no large differences in the age of the participants. Therefore, no significant relationship between students' age and implementation of personal protective measures was observed, even with stratification by age.

Previous studies have linked staying in crowded unventilated places with the high airborne transmission. One study conducted in China by Yuexia and colleagues showed that students who stayed in crowded dormitories reported higher cases of the common cold (99). Findings from the present study showed that the place of residence

(dormitory or house/apartment) neither affected international students' implementation of personal protective measures nor reported symptoms of influenza-like illnesses. This study was conducted at a time when school closure measures were implemented and learning was taking place mainly online. The number of students living in dormitories reduced substantially. Also, additional measures such as social distancing at cafeterias, wearing masks when outside the room could have caused the non-significant relationship between living in the dormitory with reported cases of influenza-like illnesses.

Since this study enrolled students from 95 countries, we were interested to find out whether the country of origin of the students affected their practice of COVID-19 measures. Previous studies that investigated the effect the country of origin on the implementation of measures against COVID-19 have revealed that implementation of these measures are higher in countries where government policies or the culture supports wearing facemasks (100). After stratification of the participants into 5 regions (Africa, Asia, Middle East, Europe, and America), we observed that the difference in the implementation of COVID-19 measures among the groups was significant ($H=11.99$, $df=4$, $p=0.003$). A pairwise comparison of the different groups showed that students from European countries implemented the personal protective measures more compared to students from African countries. Perceived risk of infection may have resulted in a higher implementation of the measures among students from the European region than the African region. At the time of the study, more coronavirus cases were reported in the European region compared to the African region (101), which may have resulted in a higher implementation among students from European countries than students from African countries. All the other pairwise comparisons by country of origin showed statistically insignificant values.

With international students from 95 countries enrolled in this study, it is possible that further relationships could have existed between the international student's country of origin and implementation personal protective measures, but that these relationships were obscured when the countries were pooled together into regions. In addition, it should be pointed out that this study was conducted in Turkey, where some of the personal protective measures such as facemasks were mandatory. This resulted to a

higher implementation of measures that were mandatory among the international students' population. For example, 97.89% (n=742) of the students either frequently or always wore facemasks when in public places, which was mandatory, while 82.85% (n=628) of the students frequently or always observed social distancing, which was not mandatory.

Therefore, the demographic and lifestyle habits that were found to affect participants' implementation of the personal measures recommended by WHO during the coronavirus pandemic were gender and smoking status. More female students implemented the measures compared to male students and students who did not smoke adhered more to wearing facemasks more compared to those who smoked.

5.2. Self-reported cases of influenza-like illnesses

International students reported whether they experienced persistent cough, fever, sore throat, headache, and fatigue between October 2020 and March 2021. It is important to note that symptoms of common cold, flu, and COVID-19 can overlap (102). Previous studies have shown that COVID-19 commonly presents with fever in up to 50% of people, dry cough, and change/loss of taste and smell (102). On the other hand, flu commonly presents with a rapid onset of symptoms including body aches, sore throat, and fever while in common cold symptoms are more gradual and rarely include fever (102). In the context of this research, students who reported symptoms of fever, sore throat, and persistent cough and who did not receive any confirmatory tests were classified as having symptoms of ILIs. This is consistent with the WHO definition of ILI as the presentation of fever, a cough, or sore throat when the causative agent is not identified (103, 104). Monthly online questionnaires were sent to the students via their students information system to minimize the recall bias. All the students who enrolled in this study were given unique numeric identifiers to track their responses during the six months of observation and at the same time maintain anonymity.

The percentage of students who reported symptoms of ILIs reduced from 20.3% (n=154) during the 2019-2020 flu season to 18.3% (n=139) during the 2020-2021 flu season (Table 4.3). Previous research has shown a decline in the cases of influenza in the year 2020 after the implementation of personal protective and community measures against COVID-19 (105). The WHO influenza virological surveillance report showed that as of March 2021, the influenza activity (the percentage of influenza-positive results in respiratory specimens submitted for influenza testing) was lower when compared to previous years (106). Similarly, the outpatient ILI surveillance showed a significant decline in the percentage of hospital visits for ILIs. The number of specimens submitted for testing was also lower during the coronavirus pandemic compared to previous years (106).

Findings regarding the role of personal protective measures on reported cases of ILIs have not been definitive. Some studies suggest that the implementation of personal protective and community measures against COVID-19 resulted in the lower reported cases of ILIs (108), and others have indicated that in addition to implementing the measures changes in hospital-seeking behavior during the coronavirus pandemic could have potentially resulted in lower reported cases of ILIs (108). The findings of a study conducted by Soo and colleagues showed a decline in hospital consultations for ILIs and influenza activity after the adoption of community and personal protective measures against COVID-19 (109). Even though the basic reproductive number (R0) of COVID-19 is higher than that of other seasonal respiratory infections, the low transmission of seasonal respiratory infections can prevent morbidity and mortality and relieve pressure from the already overburdened health systems. Other studies have suggested that low numbers of hospital consultations during the coronavirus pandemic could potentially have played a role in reduced cases of reported ILIs (108). According to the WHO global influenza surveillance report (2021), the respiratory specimens submitted for influenza testing were lower during the coronavirus pandemic compared to previous years, further suggesting that the hospital consultation and submitted respiratory specimens for influenza were lower in 2020 and 2021 compared to previous years. However, the observed decline in the influenza activity (the percentage of influenza-

positive results in respiratory specimens submitted for influenza testing) provided a more reliable estimate of the role of personal protective and community measures against COVID-19 in preventing transmission of season influenza since influenza activity is unaffected by changes in hospital-seeking behaviors (108).

Given that international students often hesitate and delay to visit hospitals when they have an ailment, the findings of this study provide important information of these students' reported cases of ILIs, which can potentially not be captured in hospital visits. Lower cases of ILIs were reported among students who had a high implementation of the personal protective measures while higher cases of ILI were reported among students who had a low implementation (Figure 4.3). Similarly, findings of the Kaplan-Meier survival analysis showed that the overall probability of becoming free of ILIs between October 2020 and March 2021 among students who had PPMS above the median score was higher compared to those who had PPMS below the median score (Figure 5.4A). Furthermore, the cumulative hazard curve showed that 25.5% of participants who scored below median reported symptoms of ILIs while 12.5 % of participants who scored above the median reported symptoms of ILIs (Figure 4.4B). These findings were consistent with previous studies, which showed that implementation of the personal protective measures as well as community measures against COVID-19 could have resulted in the observed lower cases of ILIs (107, 109).

Although the reported cases of ILIs among international students between October 2020 and March 2021 declined compared to the previous flu season, the observed percentage of students (18.3%, n=139) who reported the symptoms was higher than we expected. The findings from the present study confirmed results from previous studies that showed that although personal measures recommended by WHO prevented the community transmission of respiratory infections, changes in hospital-seeking behavior could have potentially resulted in much lower reported cases of ILIs (108, 109). This study was conducted by observing a group of students in the community between October 2020 and March 2021. Therefore, findings obtained in this study provided a broader view of the cases of ILIs among international students in the community and

clarified the role of practicing measures against COVID-19 in the cases of ILIs among international students.

5.3. Personal protective measures and prevention of ILIs

Having established that the cases of reported ILIs among international students during the 2020-2021 flu season were lower compared to the 2019-2020 flu season, we were interested to find out the role of personal protective measures in the observed reduction in the ILIs cases. We conducted a Cox proportional hazard regression analysis to clarify the personal protective measure that offered the highest protection to international students, factoring in the time of observation and censoring. Although controlled trials can establish a strong direct relationship between the implementation of measures recommended by WHO to protect against COVID-19 and ILIs, they have limited use in the community due to ethical reasons (110). Previous studies have shown that there is weak evidence of the impact of community measures and RCTs lack controls and provide low compliance results (111). The studies suggest that in observational studies, the evidence in implementing the protective measures is stronger (109). Therefore, the present observational study provided a wider evidence base of the impact of personal protective measures in preventing transmission of respiratory infections and reducing reported cases of ILIs among international students. Furthermore, the study also investigated the personal protective measure that offered international students the highest protection against ILIs.

Regarding the implementation of facemasks, results of the Cox proportional hazard regression analysis showed that students who wore facemasks were 33.6% less likely to show symptoms of influenza-like illnesses compared to students who did not wear facemask adjusting for all the other personal protective measures (Hazard Ratio=0.664, 95%CI=0.494 - 0.893, p=0.006). The study did not distinguish between cloth, surgical, and N95 masks. Thus, study results showed the effectiveness of wearing

masks in general among the international students' population. Previous studies have shown that facemasks are effective in preventing the transmission of respiratory infections. A systematic review of observational studies by Chu and colleagues on the direct impact of facemasks use in the community in COVID-19 transmission showed that mask use was 67% effective in preventing COVID-19 infection (112). The only randomized controlled study conducted by C. R. MacIntyre and colleagues before the coronavirus pandemic showed that wearing masks offered 80 % protection against ILIs after adjusting for complaint subjects (113). It is noteworthy to mention that the present study investigated the impact of personal protective measures in ILIs by observing a group of international students from 95 countries over a period of six months. Moreover, the compliance rate of facemasks among international students in the present study was 97.87% (n=742). Therefore, the results of this study on the impact of facemasks in the transmission of ILIs provide a reliable estimate of the impact of mask-wearing in preventing ILIs among students in the context where facemasks are widely adopted.

Implementation of physical distancing measures was also identified to prevent symptoms of ILIs. The proportion of students with symptoms of ILIs who always or frequently implemented physical distancing measures was significantly lower when compared to students without symptoms of ILIs ($p<0.001$). Furthermore, students who adhered to social distancing measures were 23.5% less likely to report symptoms of influenza-like illnesses when compared to those who did not adhere to social distancing adjusting for the other measures (Hazard ratio= 0.765, 95%CI=0.610 - 0.960, p=0.020). The study finding is consistent with findings from previous studies, which have shown that physical distancing measures are effective in interrupting the transmission of respiratory viruses (114). Physical distancing at the entire population level offers higher interruptions of transmission of respiratory infection and prevents most deaths. Previous studies showed that virus transmission is lower with a distance of above one meter when compared to distances below one meter. Although previous studies have shown that implementation of physical distancing reduced cases of COVID-19, studies investigating the causal relationship between physical distancing and transmission of respiratory virus infections in the community are limited. The findings of the present study are useful in

providing evidence of the general picture of the relationship between implementing social distancing measures and ILIs.

Avoiding crowded places was not identified as a factor that prevented symptoms of ILI among international students in the present study. This non-significant finding may be due to the time of study. Students may not have encountered crowed areas because other community measures such as mass gatherings, curfew restrictions, and school closures. Although studies have shown the adoption of avoiding crowded places by various population groups, evidence on the direct impact of avoiding crowded places in preventing respiratory virus infection in individuals remains scarce (115). However, there is compelling evidence that implementation of this measure on large populations, i.e. curfews and restriction of mass gatherings, significantly reduces respiratory virus transmission. Given that respiratory virus infections spread through inhaling droplets or touching the eyes and mouth with contaminated hands, avoiding crowded places reduces the risk of coming in contact with infectious droplets or surfaces. In this regard, the WHO recommended limiting social gatherings. Since studies on avoiding crowded places have shown that this measure is effective in preventing transmission of respiratory virus infection, it may be that population-based analysis can result in a link. Previous studies have suggested that assessing the impact of this measure on protecting individuals against respiratory infections presents challenges due to the complexity of factors involved(116). In the present study, it was found that the proportion of students (83.5%, n=517) who did not show symptoms of ILIs that reported to always or frequently avoid crowded places was higher when compared to students who showed symptoms of ILIs (63.3%, n=88). However, the findings of the regression analysis did not show any significant relationship between avoiding crowded places and reported symptoms of ILIs.

Studies regarding the impact of hand hygiene in preventing respiratory infections have provided mixed findings. Some studies have shown that hand hygiene reduces respiratory infections by 16-21% and diarrheal diseases by 30% in the general population (117). Yet another study conducted in a non-pandemic setting indicated that there was no significant reduction in ILIs among adults with an increased frequency of

handwashing (118). Moreover, the use of antimicrobial handwashing soaps has not been shown to add significant additional protection when compared to non-antimicrobial soaps (119). After the emergence of the coronavirus pandemic, hand hygiene was adopted as one of the primary non-pharmaceutical intervention to mitigate the it's spread. Results from the present study showed a significant association between the frequency of handwashing/disinfection and reported symptoms of ILIs among international students. In particular, students who frequently disinfected their hands were 17.1 % less likely to report symptoms of influenza-like illnesses than those who did not frequently disinfect their hands (Hazard ratio=0.821, 95%CI=0.793 - 0.915, p=0.029). This finding confirmed findings from studies that suggested hand hygiene reduces the risk of respiratory infection. It should be pointed out that the present study was conducted in a pandemic setting, and investigators observed international students from 95 countries during the 2020-2021 flu season. The handwashing compliance rate among participants in this study was high with 91.56% (n=694) of the students reporting always or frequently disinfecting their hands, especially after visiting crowded places. Therefore, the results of this study on the role of hand hygiene in the transmission of ILIs provide a reliable estimate of the impact of handwashing in preventing ILIs among students in the context of a pandemic.

Although previous studies have linked surface disinfection using alcohol-based disinfectants with reduced transmission of respiratory infections, the findings of the current research did not replicate the results. This non-significant finding may be due to the study setting and the target population. One study showed that surface disinfection was effective in reducing secondary transmission of COVID-19 transmission in households. However, there is limited scientific evidence of the effectiveness of surface disinfection in preventing the transmission of respiratory viruses in community settings. This study aimed at observing the behavior of international students in the community and investigating the impact of their behavior on reported cases of ILIs. It may be that the relationship existed but was obscured when assessing the group of international students in a community setting. Previous studies have shown that surface disinfection provides significant benefits, especially if implemented at institutions or high-risk places

(120). In the present study, the implementation of surface disinfection was lower compared to other measures. Of students with symptoms of ILIs, about 60% (n=82) reported frequently disinfect surfaces before touching and 70.4% (n=432) of those without any symptoms of ILIs reported to frequently disinfect surfaces. Therefore, further research to clarify the role of disinfecting surfaces in the transmission of respiratory virus infection in the wider community is necessary.

Overall, adherence to the five personal measures recommended to protect against COVID-19 prevented cases of ILIs among international students in the present study. Using the median personal protective measure score as cutoff, the investigators observed that students who scored below the median were 2 times more likely to have ILIs compared to students who scored above the median (Hazard Ratio=2.16, 95%CI=1.53-3.05). This showed that these measures worked synergistically and that the implementation of all the five measures recommended against COVID-19 provided higher protection when compared to the implementation of single measures.

5.4. Study strengths and limitation

The strengths of the current study included the diversity of the participants enrolled and the validity of the survey instrument. We enrolled participants from ninety-five countries located in five continents in the current study. With regards to their age, country of origin, education level, and gender, students in the current study were representative of international students in Turkey. Moreover, we enrolled a relatively large number of male (50.5%, n=383) and female (49.5%, n=375) international student, which resulted in a more reliable analysis of covariates by gender. Additionally, investigators observed the behavior of participants in the study for six months (before and during the second wave of as well as at the beginning of the third wave of the coronavirus pandemic). Thus, the current study was able to identify changes in international students' implementation of COVID-19 measures during different phases of the coronavirus pandemic. Furthermore, the PPMS Scale consisting of five measures

recommended by WHO to protect against COVID-19, and used in previous studies to measure adoption of these measures by ordinary citizens exhibited good reliability (Cronbach's alpha=0.81). Similarly, the study had good statistical power ($1-\beta = 0.86$).

On the other hand, shortcomings of the current research include possible threats to the generalization of the findings, language barrier and social desirability bias. Threats to the generalizability of the study stemmed from the selection of study participants and the design of the study. The descriptive nature of this study limits drawing any cause-effect associations and only gives an overall picture of the relationships between the implementation of measures against COVID-19 and ILIs. Moreover, the data was obtained from international students living in Ankara province, which limits the generalizing of the findings to local students or international students beyond the study setting. Since the study participants comprised international students from 95 different countries, language barrier may have prevented students who were not proficient in either English or Turkish language from accurately interpreting the questions. Finally, the study participants gave a self-reported evaluation of their implementation status of protective measures against COVID-19, which may have led to a possible overestimation of their implementation. To resolve potential social desirability bias, investigators tracked the changes in participants' practice of COVID-19 measures over time and we confirmed consistency in their implementation status. Despite these limitations, this is the first study, which we could have accessed, to investigate the adoption and practice of measures against COVID-19 by international students during the 2020-2021 flu season and clarify the effectiveness of these measures in preventing the transmission of ILIs in this group of students.

6. RECOMMENDATION

The present study recommends the following measures to improve the overall implementation of personal protective measures among the international students' population and prevent transmission of influenza-like illnesses.

1. Introduction of educational programs on how to protect from common airborne infections consistently reinforced during every academic year. According to the study results, male students had a lower implementation of the personal protective measures compared to female students. This calls for the education of male students on the importance of protecting themselves from respiratory infectious diseases. International students face the challenge of protecting their health while away from their families and their universities are their major source of community experience. Students studying non-health-related and health-related courses alike should receive these educational programs. These programs can increase awareness among students on how to protect themselves from common airborne infections, and they can apply these measures is not only in their daily lives but also in the event of an epidemic.
2. Facemasks could be used to reduce transmission during influenza epidemics, particularly in populations at highest risk of developing severe complications. Study results confirmed that the personal protective measures recommended by WHO are effective in preventing transmission of influenza-like illnesses. In particular, wearing masks was found to offer the highest protection from ILIs to international students. Acute respiratory infections are responsible for the majority of deaths among children less than five years and still contribute to substantial mortality among adults. Wearing facemasks can prevent transmission of respiratory infections resulting in reduced morbidity and mortality from these infections. After the wide adoption of mask-wearing globally, there is low or no stigmatization of individuals wearing facemasks. Therefore, in the event someone experiences acute respiratory infection in a non-pandemic setting, he/she can wear facemasks in public spaces to prevent transmission to others.

3. Health promotion campaigns targeted at improving hand hygiene should be encouraged even in the non-pandemic setting. Results of this study showed that hand hygiene reduced the likelihood of experiencing symptoms of influenza-like illnesses. Hand washing remains one of the most powerful tools to prevent the transmission of respiratory viral infections. The WHO has not provided information on the number of times a person should wash their hands in a day. However, the United States Centers for Disease Control and Prevention recommends washing hands before taking a meal, after visiting the bathroom, and after coughing or sneezing (121). In general, people's frequency of hand hygiene can be improved through continuous reminders of the circumstances and importance of hand hygiene in advertisements even in the non-pandemic setting.
4. Practice of physical distancing in non-pandemic setting by individuals with symptoms of influenza-like illness, which typically lasts between 7-10 days. Our study confirmed that physical distancing prevented symptoms of influenza-like illnesses among the international student population. After the current coronavirus pandemic, people could exercise voluntary physical distancing in the event they experiences symptoms of ILIs. It is import to note, however, that prolonged physical distancing could have detrimental effects on a people's mental health.
5. Education campaigns about the importance of personal protection and the gradual behavioral changes that can both protect individuals implementing the measures as well as the vulnerable in communities (children under 5 years and the elderly). Study results confirmed that the implementation of all the personal protective measures recommended by WHO provided higher protection when compared to the implementation of single measures. This shows that the personal protective measures do not offer additive protection to individuals but work synergistically. This finding provides policymakers with information about implementing the right set of measures, at the right time, and for the right duration to reduce the cases of respiratory infections.

7. CONCLUSION

This study investigated the practice of measures against COVID-19 among international students during the coronavirus pandemic, and the role these measures have in preventing the transmission of influenza-like illnesses. The findings of the current study not only provide an addition to the existing literature on international students' behavioral changes during the coronavirus pandemic but also identifies specific groups within the international students' population that can benefit from targeted health promotions. The study also clarifies the role of implementing recommended measures against COVID-19 in preventing the transmission of acute respiratory infections among students. This offers policymakers and healthcare providers with information about the effectiveness of these measures in preventing acute respiratory infections in populations including the international students' population, most of whom hesitate and delay seeking healthcare services.

The present study found that the demographic characteristics and lifestyle habits, which influenced the implementation of personal protective measures among international students, were gender and smoking status. Furthermore, the reported cases of ILIs among international students between October 2020 and March 2021 declined when compared to cases reported between October 2019 and March 2020. The current study also showed that wearing facemasks, physical distancing, and hand hygiene were significant factors that resulted in the decline in ILIs among international students. The study has contributed new knowledge on behavioral changes due to COVID-19 and how these newly acquired behaviors can protect people from COVID-19 and other respiratory infections. Since the present study was a descriptive study conducted in a community setting, it only gave a picture of the relationship between implementing these measures and prevention of ILIs. Therefore, future studies should focus on investigating causal associations between these measures and the transmission of respiratory infections. Future studies should also compare the implementation of these measures between local students and international students. The health of international students is essential since they contribute to the economic development their home countries by transferring the

knowledge and expertise they acquired. Therefore, their health and well-being ought to be closely monitored to ensure that they complete their education.

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APPENDICES

Appendix 1: Ethics committee permission for the study

T.C.
HACETTEPE ÜNİVERSİTESİ
Girişimsel Olmayan Klinik Araştırma Etik Kurulu

Sayı : 16969557 -1397

Konu : ARAŞTIRMA PROJESİ DEĞERLENDİRME RAPORU

Toplantı Tarihi : 06 EKİM 2020 SALI
Toplantı No : 2020/16
Proje No : GO 20/885(Değerlendirme Tarihi: 06.10.2020
Karar No : 2020/16-35

Üniversitemiz Tıp Fakültesi Anabilim Dalı öğretim üyelerinden Prof. Dr. Levent AKIN'ın sorumlu araştırmacı olduğu, Abednego Nzyuko MASAI'nın yüksek lisans tezi olan, GO 20/885 kayıt numaralı ***"Ankara'da Yüksek Öğrenim Gören Türkiye Bursları Programı Öğrencilerinin COVID-19'a Karşı Kişisel Korunma Hakkindaki Bilgi ve Davranışları"*** başlıklı proje önerisi araştımanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş olup, idari izinlerin tamamlanması kaydıyla 07 Ekim 2020-07 Hazıran 2021 tarihleri arasında geçerli olmak üzere etik açıdan **uygun bulunmuştur**. Çalışma tamamlandığında sonuçlarını içeren bir rapor örneğinin Etik kurulumuza gönderilmesi gerekmektedir.

1. Prof. Dr. Ayşe Lale DOĞAN (Başkan)
2. Prof. Dr. G. Burça AYDIN (Üye)
3. Prof. Dr. M. Özgür UYANIK (Üye)

İZİNLİ
4. Prof. Dr. Ayşe Kin İŞLER (Üye)
5. Prof. Dr. H. Tuna Çak ESEN (Üye)
6. Doç. Dr. Can Ebru KURT (Üye)
7. Doç. Dr. Nüket Paksoy ERBAYDARA (Üye)

İZİNLİ
8. Doç. Dr. Betül Çelebi SALTIK (Üye)
9. Doç. Dr. Hande Güney DENİZ (Üye)
10. Dr. Öğr.Üyesi Müge DEMİR (Üye)
11. Av. Serap MORALIOĞLU (Üye)

Appendix 2: T.C Ministry of Health permission for the study

Konu	**Bilimsel Araştırma Başvurusu**
Gönderen	Bilimsel Araştırma Başvurusu <portal@saglik.gov.tr>
Gönderici	Bilimsel Araştırma Başvurusu <portal@saglik.gov.tr>
Alıcı	<abednegomasai@hacettepe.edu.tr>
Yanıt Adresi	<noreply@portal.saglik.gov.tr>
Tarih	2020-08-11 08:08

Sayın İlgili,
Bilimsel Araştırma Platformuna yapmış olduğunuz başvuru değerlendirilmiştir.
Değerlendirme Sonucu aşağıdaki gibidir.
Onay Durumu : Bu çalışmayı yapmanız Bakanlığımızca uygun görülmüştür.
Araştırmanızın gerektirdiği diğer tüm süreçleri (etik kurul, faz çalışması ,diğer izinler vb.) tamamlamanız gerekmektedir.
Açıklama :
Form Adı : Abednego Nzyuko MASAI-2020-08-10T16_20_12
Başvuru Formu için tıklayınız.

Başvuru Formunuzu https://bilimselarastirma.saglik.gov.tr/ adresinden görüntüleyebilirsiniz.
İlginiz ve katkılarınızdan dolayı teşekkür ederiz.
T.C. Sağlık Bakanlığı
Sağlık Hizmetleri Genel Müdürlüğü
Not: Bu ileti Bilimsel Araştırmanızın Değerlendirilmesinin tamamlanması nedeniyle sistem tarafından otomatik gönderilmiştir. Lütfen bu iletiyi cevaplamayınız.

Appendix 3: Survey form

Knowledge and Behavior of International Students Studying Higher Education in Turkey towards Personal Protective Measures against COVID-19

Dear Students,

You are invited to a research conducted by the Public Health Department of Hacettepe University Faculty of Medicine. The purpose of this study is to evaluate the behavioral changes due to COVID-19 and the relationship between personal protective measures against COVID-19 and prevention of influenza-like illnesses.

International students studying in Turkey are invited to participate in this research by filling this survey and a series of short follow-up questionnaires every month from December 2020 to March 2021

Before you start to fill in the survey, we kindly ask you to understand the purpose of this research and to participate accordingly. Participation in this survey is voluntary and you may choose not to participate. The survey will take about 5 minutes to complete.

Your personal identifying information will not be collected, your answers will not be used for other purposes other than this study, all responses will be kept confidential.

In case you have any questions regarding this study, you can contact the researchers.

Thank you in advance

Researcher:

Abednego Nzyuko MASAI
abednegomasai@hacettepe.edu.tr

Supervisor:

Prof. Dr. Levent AKIN
leventa@hacettepe.edu.tr

Please click continue if give consent to participate in this study

Türkiye'de Yüksek Öğrenim Gören Uluslararası Öğrencilerinin COVID-19'a karşı Kişisel Korunma Hakkındaki Bilgi ve Davranışları

Sayin öğrenciler ,

Hacettepe Üniversitesi Tıp Fakültesi Halk Sağlığı Anabilim Dalı tarafından gerçekleştirilmekte olan bir bu araştırmaya davet edilmiş bulunmaktasınız. Bu araştırmanın amacları COVID-19 pandemi neden olduğu davranış değişiklikleri saptamak ve COVID-19'a karşı kişisel koruyucu önlemler ile grip benzeri hastalıkların önlenmesi arasındaki ilişkiyi değerlendirmektir.

Türkiye'de öğrenim görmekte olan uluslararası öğrenciler bu anketi ve Aralık 2020-Mart 2021 tarihleri arasında her ay bir kısa takip anketini doldurarak üzere bu araştırmaya katılmaya davet edilmektedir.

Ankete doldurmaya başlamadan önce bu araştırmanın ne amaçla yapıldığı anlamanız ve buna göre araştırmaya katılmanızı rica ediyoruz. Bu çalışmaya katılım gönüllülük esasına bağlıdır ve katılmamayı tercih edebilirsiniz. Anket tamamlamanız tahminen 5 dakika sürecektir.

Çalışmada, kimlik bilgileriniz istenmemektir, yanıtlarınız bu çalışma dışında başka amaçlarla kullanmayacaktır ve tüm yanıtlar gizli tutulacaktır.

Bu çalışma ile ilgili herhangi bir sorunuz olduğunda araştırmacı ile iletişime geçebilirsiniz.

Katkılarınız için şimdiden teşekkür ederiz

Araştırmacı:

Abednego Nzyuko MASAI
abednegomasai@hacettepe.edu.tr

Danışman:

Prof. Dr. Levent AKIN
leventa@hacettepe.edu.tr

Bu çalışmaya katılmak için onay verirseniz lütfen aşağıdaki linki tıklayınız

1. What is your gender? / *Cinsiyetiniz nedir?*
    a) Male / *Erkek*
    b) Female / *Kadın*

2. What is your date of birth? / *Doğum tarihiniz nedir? .....*

3. What is your country of citizenship? / *Hangi ülke vatandaşısınız?*
    (Türkiye Burlsarı Programı Kapsamında öğrencilerinin geldiği ülkeyi içeren bir liste e-ankette görülecek ve katılımcı vatandaşı olduğu ülkeyi bu ülkeler arasında seçecek)

4. Are you currently living in Turkey? / *Halen Türkiye'de yaşıyorsunuz?*
    a) Yes / *Evet*
    b) No / *Hayır*

5. Where are you currently residing in Turkey? *Türkiye'de nerede yaşıyorsunuz?*
    a) State-run dormitory / *Devlet yurdu*
    b) Private dormitory / *Özel yurt*
    c) University dormitory / *Üniversite yurdu*
    d) Apartment / *Apartman dairesi*
    e) I am not residing in Turkey / Turkiy'de yaşamıyorum
    f) Other (Please specify) / *Diğer (Lütfen belirtiniz)……..*

6. Do you have any chronic illness that was diagnosed at a health facility? / *Bir sağlık kuruluşu tanısı konmuş herhangi bir kronik hastalığınız var mı?*
    a) Yes / *Evet*
    b) No / *Hayır*

7. Do you smoke cigarette or hookah? / *Sigara veya Nargile içiyor musunuz?*
    a) Yes / *Evet*
    b) No / *Hayır*

8. During September 2019 – March 2020 period, did you experience symptoms such as persistent cough, fever, runny and stuffy nose, and sore throat? / *Eylül 2019 - Mart 2020 tarihleri arasında öksürük, ateş, burun akıntısı ve boğaz ağrısı gibi belirtiler gösterdiniz mi?*
    a) Yes / *Evet*
    b) No / *Hayır*
    c) I don't remember / *Hatırlamıyorum*

9. Have you had symptoms such as cough, fever or chills, sore throat, stuffy nose and body aches during the last 30 days? / *Son 30 gün içinde öksürük, ateş veya titreme, boğaz ağrısı, tıkalı burun ve vücut ağrıları gibi belirtiler gösterdiniz mi?*
    a) Yes / *Evet*
    b) No / *Hayır*

10. Please read following questions carefully and tick the most appropriate answer according to you. There is no wrong and wright answer. / *Lütfen aşağıdaki soruları dikkatlice okuyunuz ve size göre en uygun cevabı işaretleyiniz. Yanlış ve doğru bir cevap yok.*

5	4	3	2	1
Always / Her zaman	Frequently / Sık sık	Occasionally / Ara sıra	Rarely / Nadiren	Never / Hiçbir zaman

How often do you / Ne sıklıkla					
wear a mask when in public places and when around others? / *Kamu açık alanlarda veya başkalarının yanındayken maske takıyorsunuz?*					
maintain a distance of at least 1 meter between you and others? / *Siz ve diğer kişilerin arasında en az 1 metrelik mesafeyi koruyorsunuz?*					
disinfect your hands especially after coming from public spaces? / *özellikle kamusal alanlardan geldikten sonra ellerinizi dezinfekte ediyorsunuz?*					
clean and disinfect surfaces such as tables, phones, doorknobs and handles? / *Masalar, telefonlar, kapı kolları ve kulplar gibi yüzeyleri temizleyip dezenfekte ediyorsunuz?*					
avoid going to crowded places? / *Kalabalık alanlara gitmekten kaçınıyorsunuz?*					
avoid touching your eyes, nose and mouth, and if necessary disinfect your hands before touching? / *Gözlerinize, burnunuza ve ağzınıza dokunmaktan kaçınıyorsunuz ve gerekirse dokunmadan önce ellerinizi dezenfekte ediyorsunuz?*					

Knowledge and Behavior of International Students Studying Higher Education in Turkey towards Personal Protective Measures against COVID-19

Follow-up questionnaire

Dear Students,

Thank you for your participation in the research entitled 'Knowledge and behaviour of International Students Studying Higher Education in Turkey Towards Personal Protective Measures against COVID-19' conducted by the Public Health Department of Hacettepe University Faculty of Medicine. Your candid responses in the questionnaire is highly appreciated.

You are invited to continue participating in the study by answering this follow-up questionnaire. Before you start to fill in the questionnaire, we kindly ask you to understand the purpose of this research and to participate accordingly. Participation in this research is voluntary and you may choose not to participate. The survey will take about 5 minutes to complete.

Your personally identifying information will not be collected and your answers will not be used for other purposes other than this study, all responses will be kept confidential.

In case you have any questions regarding this study, you can contact the researchers.

Thank you in advance

Researcher:

Abednego Nzyuko MASAI
abednegomasai@hacettepe.edu.tr

Supervisor:

Prof. Dr. Levent AKIN
leventa@hacettepe.edu.tr

Please click continue if give consent to continue participating in this study

Türkiye'de Yüksek Öğrenim Gören Uluslararası Öğrencilerinin COVID-19'a karşı Kişisel Korunma Hakkındaki Davranışları

Takip anket

Sayin Öğrenciler,

Hacettepe Üniversitesi Tıp Fakültesi Halk Sağlığı Anabilim Dalı tarafından yürütülen 'Türkiye'de Yüksek Öğrenim Gören Uluslararası Öğrencilerin COVID-19'a karşı Kişisel Korunma Hakkındaki Bilgi ve Davranışları' başlıklı araştırmaya katılımınız için teşekkür ederiz. Anketteki samimi yanıtlarınız takdir edilmektedir.

Bu takip anketini doldurarak çalışmaya katılmaya devam etmeye davet ediyoruz. Ankete doldurmaya başlamadan önce bu araştırmanın ne amaçla yapıldığı anlamanız ve buna göre araştırmaya katılmanızı rica ediyoruz. Bu çalışmaya katılım gönüllülük esasına bağlıdır ve katılmamayı tercih edebilirsiniz. Anket tamamlamanız tahminen 5 dakika sürecektir.

Çalışmada, kimlik bilgileriniz istenmemektir, yanıtlarınız bu çalışma dışında başka amaçlarla kullanmayacaktır ve tüm yanıtlar gizli tutulacaktır.

Bu çalışma ile ilgili herhangi bir sorunuz olduğunda araştırmacı ile iletişime geçebilirsiniz.

Katkılarınız için şimdiden teşekkür ederiz

Araştırmacı:

Abednego Nzyuko MASAI
abednegomasai@hacettepe.edu.tr

Danışman:

Prof. Dr. Levent AKIN
leventa@hacettepe.edu.tr

Bu çalışmaya katılmaya devam etmek için onay verirseniz lütfen aşağıdaki linki tıklayınız

1. What is your date of birth? / *Doğum tarihiniz nedir?* .....
2. Are you currently living in Turkey? / Halen Türkiye'de yaşıyorsunuz?
   Yes / Evet
   No / Hayır
3. Have you experienced any symptoms such as cough, fever or chills, runny and stuffy nose, body aches and headaches during the month of (depending on the month, from October 2020 to March 2021)? / *Aralık ayında öksürük, ateş veya titreme, burun akıntısı, vücut ağrıları ve baş ağrısı gibi belirtiler yaşadınız mı?*
   a) Yes / Evet
   b) No / Hayır
4. How long did the symptoms last / *Belirtiler ne kadar sürdü*
   a) Less than 1 week / *1 haftadan az*
   b) 1 week / *1 hafta*
   c) More than 1 week / *1 haftadan fazla*
   d) I still have the symptoms / *Hala belirtiler var*

How often do you / Ne sıklıkla					
wear a mask when in public places and when around others? / *Kamu açık alanlarda veya başkalarının yanındayken maske takıyorsunuz?*					
maintain a distance of at least 1 meter between you and others? / *Siz ve diğer kişilerin arasında en az 1 metrelik mesafeyi koruyorsunuz?*					
disinfect your hands especially after coming from public spaces? / *özellikle kamusal alanlardan geldikten sonra ellerinizi dezinfekte ediyorsunuz?*					
clean and disinfect surfaces such as tables, phones, doorknobs and handles? / *Masalar, telefonlar, kapı kolları ve kulplar gibi yüzeyleri temizleyip dezenfekte ediyorsunuz?*					
avoid going to crowded places? / *Kalabalık alanlara gitmekten kaçınıyorsunuz?*					
avoid touching your eyes, nose and mouth, and if necessary disinfect your hands before touching? / *Gözlerinize, burnunuza ve ağzınıza dokunmaktan kaçınıyorsunuz ve gerekirse dokunmadan önce ellerinizi dezenfekte ediyorsunuz?*					

Appendix 4: Digital receipt

turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Abednego Nzyuko Masai
Assignment title:	Theses
Submission title:	KNOWLEDGE AND BEHAVIOR OF INTERNATIONAL STUDENTS...
File name:	Thesis_Abednego_Nzyuko_MASAI_05.07_turnitin.docx
File size:	1.84M
Page count:	69
Word count:	14,682
Character count:	85,973
Submission date:	05-Jul-2021 03:00AM (UTC+0300)
Submission ID:	1615709984

T.C.
REPUBLIC OF TURKEY
HACETTEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES

KNOWLEDGE AND BEHAVIOR OF INTERNATIONAL STUDENTS STUDYING HIGHER EDUCATION IN TURKEY TOWARDS PERSONAL PROTECTIVE MEASURES AGAINST COVID-19

Abednego Nzyuko MASAI

Public Health
MASTER OF SCIENCE (MSc) THESIS

ANKARA
2021

Appendix 5: Originality report

KNOWLEDGE AND BEHAVIOR OF INTERNATIONAL STUDENTS STUDYING HIGHER EDUCATION IN TURKEY TOWARDS PERSONAL PROTECTIVE MEASURES AGAINST COVID-19

ORIGINALITY REPORT

3%	2%	2%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	"Poster Session Clinical", European Journal of Heart Failure, 2013. Publication	<1%
2	Abednego Nzyuko Masai, Bahar Güçiz-Doğan, Polet Njeri Ouma, Israel Nyaburi Nyadera, Victor Kipkoech Ruto. "Healthcare services utilization among international students in Ankara, Turkey: a cross-sectional study", BMC Health Services Research, 2021 Publication	<1%
3	nepad.org Internet Source	<1%
4	Ye Jin Lee, Young Sik Park, Hyun Woo Lee, Tae Yun Park, Jung Kyu Lee, Eun Young Heo. "Peripheral Lymphocyte Count as a Surrogate Marker of Immune Checkpoint Inhibitor Therapy Outcomes in Patients with Non-Small-Cell Lung Cancer", Research Square Platform LLC, 2021 Publication	<1%

RESUME