University of Applied Sciences

Faculty of Life Sciences

Health Sciences Degree

Assessing Knowledge, Perception, and Source of information about Covid-19 among HAW Hamburg students.

Master Thesis

For the degree

Master of Public Health(MPH)

Submitted by: Michael Agbor, Njang-Tyson

[redacted]

Examination supervisor: Prof. Dr Ralf Reintjes

Secondary supervisor: Mr Kenneth Asang

Date of Submission: 09.02.202

Hamburg, Germany

DECLARATION

I Michael Agbor Njang-Tyson, declare that this thesis “Assessing Knowledge, Perception, And Source of Information about Covid-19 Among Haw Hamburg Students”, presented the original work carried out by me under the supervision of Prof. Dr Ralf Reintjes and Mr Kenneth Asang. I confirm that this research work was carried out while I was still a master student at the Hamburg University of Applied Sciences. In this research work, I accessed the past published research work of others and used all of the sources appropriately.

…….. ……...

Michael Agbor, Njang-Tyson Date
Primary Researcher(Student HAW Hamburg)

…….. ……

Prof. Dr Ralf Reintjes Date
Faculty of Life Sciences HAW Hamburg
Department of Health Sciences
(First Supervisor)

…….. ……...

Mr Kenneth Asang Date
Assistant Lecturer
Faculty of Life Sciences HAW Hamburg
Department of Health Sciences
(Second Supervisor)

ACKNOWLEDGEMENT

I would like to thank my supervisors, Prof. Dr Ralf Reintjes and Mr Kenneth Asang for their mentorship and support through my research work. A special appreciation to my course coordinators, Miss. Wiebke Bendt and Mr Gunnar Paezelt for their assistance throughout my studies. My sincere gratitude to all MPH lecturers at the HAW Hamburg and to all the students who made out time to answer my survey, I am indeed grateful, and I will not forget your kind gesture in a hurry.

A special appreciation and gratitude to my entire family, especially Mr Dominique Agbor Tarh and Mr Betrand Njang Tarh for their endless support throughout my studies, not leaving out my friends for their support and encouragement, and all those who contributed in one way or the other for the successful completion of my studies. May God continue to bless us with wisdom.

ABSTRACT

Introduction: An emerging outbreak of the novel coronavirus COVID-19 (coronavirus disease 2019), the pathogen called SARS-CoV-2, previously known as 2019-nCoV which originated from Wuhan in China and has now spread to more than 100 countries, as of March 23, 2020(1). As several Countries prepare to go on lockdown, health authorities have already initiated awareness and preparedness programs globally. Poor knowledge, perception or misinformation of the public may result in the rapid spread of the infection. The study aims to investigate the association that exists between the source of information, knowledge, and perception.

Method: This research project adopted a Cross-sectional study design using online survey questionnaires to obtain data from HAW Hamburg students. The distribution of baseline characteristics is described by varying questionnaires. The chi-square test was used to investigate the level of association between study parameters. A *p-value* < 0.05 was considered statistically significant, SAS 9.4 was used for analysis.

Results: Out of 1017 participants, 959 students completed the survey (94.3% response rate), with a total of 383(39.9%) male, 571(59.5%) female students, including 5(0.5%) gender-diverse students. Most respondents were < 30 years of age (n = 748, 78.0%), bachelor students (n = 682, 71.1%), and in the second semester (n = 172, 17.9%).

Respondents(n=590, 80%) with reliable sources of information were more likely to agree or strongly agree to cover their mouth when coughing or sneezing compared to respondents (n=159, 72%) who got their information from unreliable sources(p=0.015).

Generally, there was no statistical evidence to suggest any impact of knowledge(Causative agent) versus sources of information (p=0.078) or knowledge(causative agent) versus perception (about covering of mouth when coughing or sneezing)(p=0.923).

Conclusion: The study reveals that the protective actions taken by individuals against COVID-19 are influenced by their source of information. Thus, the need to widen a reliable source of information becomes an issue of both national and international concern.

TABLE OF CONTE

List of Tables

CHAPTER ONE

1.0. Introduction

1.1. Background of the study

The taxonomic classification of viruses places Coronaviruses in a large family of single-stranded RNA enveloped viruses. This family is further divided into four groups called genera i.e., alpha, beta, gamma, and delta-coronaviruses (1–3). The Alpha and the beta-coronaviruses are known to infect only mammals, while the gamma and the delta-coronaviruses infect birds and mammals in some cases (1–3). Among these genera of coronaviruses (CoVs) that infect mammals, six have been identified as human-susceptible viruses, and further divided into two groups (1–8): Firstly, those that cause mild respiratory symptoms like a common cold with low pathogenicity: α-CoVs HCoVs-229E and HCoVs-NL63, and β-CoVs HCoVs-HKU1, and HCoVs-OC43 and Secondly, those that lead to severe and potentially fatal respiratory tract infection: β-CoVs, SARS-CoV-1 which emerged in China in March 2003 and cause a large-scale epidemic with about 8000 infections and 800 deaths(4,5) and MERS-CoV which caused a persistent epidemic in the Arabian Peninsula since 2012(4,6,7), And the novel SARS-CoV-2(Covid-19), identified from a cluster of patients with pneumonia of unknown cause, epidemiologically linked to a seafood market in Wuhan, Hubei province China that emerged in December 2019, making a total of seven identified coronaviruses that infect humans (1,8).

Globally, 12 768 307 COVID-19 cases, with 566 654 deaths have been reported as of 13 July 2020(46,47). In Germany, the first confirmed COVID-19 case was reported on the 27 of January 2020, in Bavaria(47) and recent reports by RKI(Robert Koch Institut) reveals 198,963 infected cases and 9064 deaths all over Germany as of 13 of July 2020(47,48). Furthermore, an extensive analysis of data from Germany's national surveillance system on laboratory-confirmed COVID-19 cases confirms the occurrence of COVID-19 outbreaks in schools(49).

Following the public health measures (such as restriction of mass gathering allowing people to meet a maximum of one other person or people from the same household, keeping a social distance of 1.5 meters from others, go to work or use public transport only when necessary) that were taken in many countries including Germany in March 2020, people suddenly had to adjust to a completely new situation(50). Nevertheless, we all know that younger individuals often engage in controversial behaviours especially at the beginning of the pandemic such as the organisation of mass events or parties(51), which could increase the risk of exposure to

COVID-19 infection. This research project, therefore, aims to investigate the association between knowledge, perception, and source of information among students in HAW Hamburg.

1.2. RESEARCH GAPS

- There is a large gap in research on the novel SARS-CoV-2(Covid-19) epidemiological data due to the sudden outbreaks.
- Research gaps also exist on risk perception, understanding and communication.
- The risks of the pandemic do not only affect the medical system but also have strong socio-economic, behavioural, psycho-social, governance and technological implications (42).

Thus, researching on the knowledge, perceptions, or the behavioural aspect of individuals especially the young adult during the pandemic will help close some of the existing research gaps.

1.3. STATEMENT OF PROBLEM

Coronavirus infection is a huge public health problem worldwide which has become a major concern for people and governments (40), with a critical effect on the global economy, healthcare systems and medical expenditure (41). Following the public health measures that were taken by governments to mitigate the COVID-19 pandemic, many individuals adopted new behavioural changes to help them cope during the outbreak. Since younger individuals especially students may engage in controversial behaviours(e.g., organisation of parties or mass events) at the beginning of the pandemic, understanding student's knowledge, perception, and source of information about COVID-19 will help improve how risk is communicated at different levels of a targeted population.

1.4. AIM AND OBJECTIVES

The study aims to investigate the association that exists between the sources of information, knowledge, and perception.

1.4.1. Research Objectives

- Assessing the level of knowledge and perception of COVID-19 among HAW students.
- Determine the source of information about COVID-19 among HAW students
- Assess behavioural modifications during Covid-19 outbreak.

1.4.2. Research Hypothesis

(Ho) – HAW students will display a high level of knowledge about covid-19.
(Ha) – HAW students will display a knowledge deficit about Covid-19.

1.4.3. Research Questions

- How much do HAW students know about Covid-19 and what are their perceptions about the pandemic?
- What sources do the students get their information from?
- Are there any behavioural modifications among HAW Students during the COVID-19 outbreak?

1.5. SIGNIFICANCE OF THE STUDY

Behaviour plays one of the most important roles not only in the governance of every society but also in pandemic response (42). Thus, conducting behavioural link research amongst students (HAW Hamburg) who represent a significant intellectual proportion of the population in every society, will cause modifications in behavioural and social changes, and the way risk is being perceived, understood, and communicated.

CHAPTER TWO

2.0. LITERATURE REVIEW/EPIDEMIOLOGY

2.0.1. The scope of Covid-19 outbreak

During the last week of December 2019, a novel coronavirus, Covid-19(coronavirus disease 2019), the pathogen called SARS-CoV-2, previously known as 2019-nCoV emerge from a cluster of patients with an unexplained cause of pneumonia, epidemiological sources of exposure pointing to a seafood market in Wuhan, Hubei province China (1,9). As the disease advances, other clusters of confirmed cases who never had any history of travelling or without clear exposure to the seafood market in Wuhan, where also identified in other parts of the world (10–12).

According to the latest WHO (world health organization) report, the virus has now spread to over 200 countries in the world, with over 2 160 207 confirmed cases and 146 088 deaths recorded, as of April 18, 2020(13). Currently, the number of infections and deaths is still increasing. The disease seriously threatens human health, production, life, social functioning, and international relations, and has caused widespread concern around the globe (14).

2.1. Host and reservoir

Discoveries suggest that bats and wild animals may be the natural reservoirs host for many viruses such as Ebola, Nipah, including coronavirus (2,15). Other studies point that SARS-CoV-2 likely originated from bats like the SARS-CoV, MARS-CoV, and many other coronaviruses, but further evidence is still required to confirm whether the pneumonia infection caused by SARS-CoV-2 is directly transmitted from bats or through an intermediate host such as civets, snakes, minks, pangolins, etc (8,16–19). Other studies found that the SARS-CoV-2 is 96% identical to the bat coronavirus on a whole-genome level, making bats the most possible host for SARS-CoV-2(20,21). One of the most important processes in the emergence of viruses is the jump from animals to humans and identifying the source of the virus will go a long way to control its propagation (21).

2.2. Route of transmission

A few routes of transmission of the virus have been identified and further divided into direct contact transmission (independent of surface contamination) and indirect contact transmission (involving contamination of inanimate surfaces), but many transmission routes remain unidentified or have been identified but not yet enough evidence to prove the claim. After a thorough literature search, the following routes of transmission were identified or considered as a possible source of contamination:

2.2.1. Human to human transmission

Chan and his colleagues investigated a family of six patients from Shenzhen who travelled to Wuhan between Dec 29, 2019, and Jan 4, 2020. But none of them had contacts with the Wuhan seafood market or animal source. Their findings show that five family members were infected with Covid-19, thus, confirming person to person transmission (1,22).

Another study conducted by Phelan *et al* identified evidence of transmission along a chain of 4 “generations” i.e. A person who originally contracted the virus from a non-human source infected someone else, who infected another individual, who then infected another individual, suggesting sustained human-to-human transmission (1,23,24).

2.2.2. Aerosol droplets

In the absence of concrete evidence on the source of the SARS-CoV-2, the main source of infection remains the patients presenting with pneumonia, infected by the SARS-CoV-2. Respiratory droplet transmission is the main route of transmission, and it can also be transmitted through inhalation of aerosol particles and droplets and contact with infected persons (1,11,25).

2.2.3. faecal-oral transmission

Though not scientifically proven that eating virus-contaminated food causes infection and transmission, the SARS-CoV-2 virus was recently detected in the faeces of confirming Covid-19 patients in Wuhan, Shenzhen, and the first case in the United States, indicating that the virus can replicate in the digestive tract implying the possibility of faecal-oral transmission (1,26).

2.2.4. Mother to child

Yang and colleagues concluded based on the available data that, the clinical characteristics of patients with Covid-19 infection presenting from the mid-trimester onwards are like those of non-pregnant adults, and that, there is no evidence that pregnant women are more susceptible to Covid-19 infection, but those with Covid-19 infection are more prone to developing severe pneumonia. They also concluded that there is no evidence of vertical (mother to child) transmission of Covid-19 infection when the maternal infection manifests in the third trimester (27). On the contrary, other studies reported the isolation of the novel SARS-CoV-2 in a pharynx swab from a neonate 30 hours postpartum, after the mother confirmed positive of Covid-19. Thus, suggesting mother to child transmission (1). In all, there is the need for more scientific studies to confirm the above claims as the theories on mother-child transmission remains unclear.

2.2.5. Inanimate objects and surfaces

Intense analysis of studies by Kampf and colleagues reveals that human coronaviruses such as Severe Acute Respiratory Syndrome (SARS) coronavirus, Middle East Respiratory Syndrome (MERS) coronavirus or endemic human coronaviruses (HCoV) can persist on inanimate surfaces like metal, glass, or plastic for up to 9 days and can be efficiently inactivated by surface disinfection procedures with 62–71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite within 1 minute (28–30).

2.3. Incubation period

The world health organization (WHO) defines the incubation period as “the time between being infected with the virus and the development of symptoms of the disease”. Based on studies, an average of the incubation period of Covid-19 is estimated to range from 1-14 days (1,25).

2.4. Symptoms

Based on most publications, Covid-19 patients can be classified as either:

- Symptomatic: present observable features of the infection which include fever, tiredness, and dry cough, while some patients may have aches and pains, nasal congestion, runny nose, sore throat, or diarrhoea (25,31,32).
- Asymptomatic: do not present any feature of the disease after being infected and do not feel unwell (25,31,32). This confirms the reason while social distancing is important during the Covid-19 pandemic.
- In general, older people, and those with underlying medical problems like high blood pressure, heart problems or diabetes, are more likely to develop serious illness (1,25). People with fever, cough and difficulty breathing should seek medical attention.

2.5. Diagnosis

The diagnosis of Covid-19 involves both clinical and laboratory diagnosis. While clinal diagnosis is based on examining patients for physical symptoms and CT image examination (Chest X-ray examination), the laboratory diagnosis is based on isolation, identification, and differentiation SARS-CoV-2 from other known viruses of pneumonia, such as influenza viruses, parainfluenza virus, adenovirus, respiratory syncytial virus, rhinovirus, SARS-CoV, MERS-CoV, etc., by real-time polymerase chain reaction (RT-PCR) (1,2,19,33).

2.6. Case definition

The world health organisation (WHO) defines cases as suspected, probable, confirm, and definition of contacts (10,13).

2.6.1. Suspected Cases

- Suspected cases are further categorised as follows:

- A patient with acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath), AND a history of travel to or residence in a location reporting community transmission of Covid-19 disease during the 14 days before symptom onset. OR

- A patient with an acute respiratory illness AND having been in contact with a confirmed or probable Covid-19 case (see definition of contact) in the last 14 days before symptom onset. OR

- A patient with severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath, AND requiring hospitalization) AND in the absence of an alternative diagnosis that fully explains the clinical presentation.

2.6.2. Probable case

- A suspect case for which testing for the Covid-19 virus is inconclusive. a. Inconclusive being the result of the test reported by the laboratory. OR
- A suspect case for which testing could not be performed for any reason.

2.6.3. Confirmed case.

A person with laboratory confirmation of Covid-19 infection, irrespective of clinical signs and symptoms.

2.7. Definition of contact

A contact is a person who experienced any one of the following exposures during the 2 days before and the 14 days after the onset of symptoms of a probable or confirmed case:

- Face-to-face contact with a probable or confirmed case within 1 meter and for more than 15 minutes.
- Direct physical contact with a probable or confirmed case.
- Direct care for a patient with probable or confirmed Covid-19 disease without using proper personal protective equipment1. OR
- Other situations as indicated by local risk assessments.

2.7.1. Definition of COVID-19 death

COVID-19 death is defined for surveillance purposes as a death resulting from a clinically compatible illness in a probable or confirmed COVID-19 case unless there is a clear alternative cause of death that cannot be related to COVID disease (e.g., trauma). There should be no period of complete recovery between illness and death (34).

2.7.2. Treatments and Preventions

Up-till-date, there is no evidence of a scientifically proven drug or vaccine against the new coronavirus in patients suspected or confirmed to have Covid-19(1,11,25). Thus, management of cases is based on underlined principles, suspected, and confirmed cases need to be treated in designated hospitals with effective isolation and protection conditions. Suspected cases need to be treated separately in a single room, confirmed cases are admitted to the same ward, and critical cases should be admitted to ICU as soon as possible (11).

The general strategies for managing cases, for now, remains bed rest, supportive therapy including antiviral therapy, organ function support, respiratory support, bronchoalveolar lavage (BAL), blood purification and extracorporeal membrane oxygenation (ECMO) (1).

Measures of control include (1,25):

- frequent hand washing
- Covering of mouth during coughing or sneezing with the elbow or tissue
- maintain a distance of at least 1.5 meters from other people.
- Staying at home
- Wearing a protective mask
- Travel restriction

2.8. Covid-19 infodemic

The Covid-19 outbreak has been a devastating pandemic infecting over 3 018 681 people (confirmed cases) leading to more than 207 973 deaths all over the world as of April 29, 2020(35)., and the most challenging aspect of the outbreak is the absence of a scientifically proven vaccine or treatment. Therefore, educating the public remains the key strategy to empower the public to mitigate the outbreak. But due to the increased use of smart devices(smartphones, computers, etc.) and their diverse applications which include but not limited to social media channels such as WhatsApp, Facebook, Instagram, LinkedIn, Twitter, Weibo etc., and other internet communication channels, communicating risk to the public in this era becomes even more difficult(36). Thus, giving rise to objective questions which focus on the validity and reliability of the information and its sources. This then brings us to another outbreak of infodemics.

According to WHO, an infodemic is the overabundance of information, some accurate and some not that makes it hard for people to find trustworthy sources and reliable guidance when they need it (13). The most obvious consequences of an infodemic are, the discordance of information that confuses and can provoke irrational fear, mass panic, and ultimately imposes a destabilising effect on the society when precisely the opposite is required (36)., which therefore means that information spreading can strongly influence people´s behaviour and alter the effectiveness of the countermeasures deployed by governments (37).

2.8.1. Examples of infodemics

A typical example of an infodemic is seen in a region in the north of Italy call Lombardy when CNN anticipated a rumour about the possible lock-down to prevent the pandemic, publishing the news hours before the official communication from the Italian Prime Minister. This led to overcrowded train stations and airports as people escape from Lombardy towards the southern regions before the lock-down was in place, thus disrupting the government initiative aimed to mitigate the pandemic (37). Another example is seen when people express unusual behaviours like hoarding toilet papers and groceries, typically observed in supermarkets and shopping malls, dramatized by images of empty shelves circulating on social media.

CHAPTER THREE

3.0. Methodology

This research adopted a cross-sectional study design using online survey questionnaires to obtain data from HAW Hamburg students

3.1. Rationale for the chosen methods

A crossed-sectional design was chosen because the study was aimed at investigating the association that exists between the source of information, knowledge, and perception of HAW Hamburg students about COVID-19 from 14 April to 18 April 2020.

Secondly, an online survey was done to avoid any sort of physical contacts with respondents (HAW students), since the study aims to provide information that will mitigate the spread of the virus. Also, due to preventive measures such as social distancing, the closing of schools, etc., put in place to contain the Covid-19. Thus, a cross-sectional online random survey to target respondents remains the golden method of choice.

3.2. Data collection Tool

A survey containing multiple-choice Electronic questionnaires composed of 30 closed-ended questions designed in four sections i.e., demography, knowledge, perception, and source of information, after a considerate search for most recent available scientific literature from PubMed, Google Scholar, WHO, Centre for Disease Control and prevention, and Robert Koch Institute. SurveyMonkey was used to design questionnaires and collect responses both in English and German Languages.

3.3.1. Inclusion and Exclusion criteria

A. **Inclusion criteria**

- All students enrolled in HAW Hamburg (Hochschule für Angewandte Wissenschaften Hamburg), irrespective of their course of study.
- Students who were willing to take part in the survey.
- Students having a smartphone or computer and an internet connection.
- Those who completed the survey.

B. **Exclusion criteria**

- Non-HAW Hamburg students or visiting students.
- Students who did not want to take part in the survey.
- Students with no smartphones or computers.
- Those who did not complete the survey.

3.4. Inform Concern (IC)

Inform concern was obtained from students including information on data protection rights. Participation in the survey was based on Free will.

3.4.1. Data Analysis

Statistical analysis was done using SAS 9.4. The frequencies and proportions of the study data were calculated utilizing descriptive analysis. The chi-square test was used to investigate the level of association among variables. A *p-value* < 0.05 was considered statistically significant.

3.4.1.1. Definition of Study Parameters (Source of Information, Knowledge and Perception).

Source of Information

The different sources of information were dichotomised into **Reliable (RSI) and Non-reliable sources of information (NRSI)** (44) and then correlated with other parameters (Knowledge and Perception) to check for the possible association.

1) **Reliable Sources of information (RSI)**: These include sources of information which are considered to provide evidence-based information with well-reasoned theories, arguments, and discussions; Scientific Journals, newspapers, WHO website, National health Country Website, TV, Newspapers etc.
2) **Non-Reliable Sources of information (NRSI)**: Family, friends, and Neighbours, Social Media channels etc.

Level of Knowledge

The level of knowledge about Covid-19 was also dichotomised into Knowledgeable and Not Knowledgeable about Covid-19 (6, 39)and then correlated with other parameters (Source of information and Perception) to checked for the possible association.

- Knowledgeable about Covid-19: Those considered to have sufficient information about Covid-19 based on the survey.
- Not Knowledgeable about Covid-19: Those considered having insufficient information about Covid-19 based on the survey.

Perception

Longman Dictionary of Contemporary English defines perception as(45):

a) the way you think about something and your idea of what it is like

b) the way that you notice things with your senses of sight, hearing etc.

c) the natural ability to understand or notice things quickly.

3.4.1.2. Main Comparison Between Study Parameters

The project will consider assessing any association between study parameters by analysing the following comparisons.

1. Association between the source of information and perception about COVID-19
2. Association between the source of information and knowledge about COVID-19
3. Association between perception and knowledge parameters(e.g., causative agent, incubation period etc.) about COVID-19.

3.4.2. Sample size

A historical sample size calculation was employed in calculating the sample size of this study. An average of 319 was calculated as the sample size (6,7,38-40). The survey was sent to a total of 19.763 students, and 1017 students responded within 5 days. Due to the rapid increasing responses, the survey was closed since the total responses were already 3 times more than the calculated sample size. Therefore, the findings of this study are based on 1017(5%) responses.

3.4.3. Duration of study

The survey lasted for 5 days that is from 14 April to 18 April 2020.

CHAPTER FOUR

4.0. RESULTS

4.1. General Characteristics

4.1.1 Demographic Distribution of the Study Population

Out of 1017 students who participated in the survey, 959 students completed the survey (94.3% response rate), with a total of 383(39.9%) male, 571(59.5%) female students, including 5(0.5%) gender-diverse students. Most respondents were < 30 years of age (n = 748, 78.0%). A greater proportion of the respondents were bachelor students (n = 682, 71.1%), and most of them were in their second semester (n = 172, 17.9%). All departments were represented with the department of Design, Media Technology and Information having the highest number of participants (n = 138, 14.4%), department of Social Works (n = 102, 10.6%), Public Health Sciences (n = 99, 10.3%), compared to the department of Production Management with the lowest number of participants (n = 21, 2.2%).

Table 1. Demographic Distribution of the Study Population

	Responses	**Percentages (%)**
Q1: Age (years)		
< 30 years	748	78.00
>= 30 years	211	22.00
Q2: Gender		
Male	383	39.94
Female	571	59.54
Diverse	5	<5
Q3: Enrolled Academic degree		
Bachelor	682	71.12
Master	140	14.60
PHD	4	<5
Other	133	13.87

Table 2.0 Distribution According to the Course of Study.

Q4: study courses	**Responses**	**Percentages (%)**
Automotive & Aeronautical	36	<5
Information Engineering	25	<5
Electrical Engineering	57	5.94
Mechanical Engineering	68	7.09
Production Management	21	<5
Computer Science	52	5.42
Biotechnology	35	<5
Biomedical engineering	28	<5
Renewable energies and process engineering	35	<5
Nutrition and health	50	5.21
Public Health Sciences	99	10.32
Hazard control and rescue engineering	29	<5
Industrial engineering	28	<5
Design, Media Technology, and Information	138	14.39
Department of Business	72	7.51
Department of Social Work	102	10.64
Department of Public Management	48	5.01
Department of Nursing & Management	36	<5

Table 2.1 Distribution According to Actual Semester

Q5: Actual Semester	**Responses**	**Percentages (%)**
Semester 1	127	13.24
Semester 2	172	17.94
Semester 3	112	11.68
Semester 4	149	15.54
Semester 5	78	8.13
Semester 6	126	13.14
Semester 7	70	7.30
Semester 8	53	5.53
Semester 9	25	<5
Semester 10	47	<5

4.2. Distribution According to Source of Information about Covid-19.

Data from the survey elucidate that majority of students depended on TV stations for information about COVID-19 (n= 624, 65.1%) and the national health website like Robert-Koch institute (n=553, 57.7%), while 443(46.2%) got their information on social media, 422(44%) from family, friends, and neighbours. On the other hand, a lesser proportion of students searched for scientific journals (n=135, 14.1%) or information from the WHO website (n=261, 27.2%), as seen in table 3.

Table 3. Showing Source of information about Covid-19.

Q6: Source of information	Responses(N=959)	Percentages (%)
TV	624	65.1
Radio	389	40.6
Newspaper	384	40
Family, Friends, and Neighbours	422	44
Scientific journals	135	14.1
Social media channels	443	46.2
WHO website	261	27.2
National health country website	553	57.7
Google	320	33.4
Others*	155	16.2

Note: Others* include additional sources of information that will further be discussed in table 4

4.3.Additional sources of information about Covid-19

In addition to the above-stated sources of information, a minority(N=155) of students got additional information from national online message-portals like "Spiegel" (n =52, 33.55%), Podcast (n=31, 20%), and YouTube (n=18, 11.61%), while a much lesser minority got additional information from workplaces (n =2, 1.29%) as seen on the table below.

Table 4. Showing Additional Sources of information about Covid-19.

	Responses(N=155)	Percentages (%)
Online-Nachrichten portal z.b spiegel, Tagesschau, etc.	52	33.55
Drosten	10	6.45
Workplaces	2	1.29
NDR online	11	7.1
Podcast	31	20
John Hopkins	7	4.5
Youtube	18	11.61
Zeitungs App z.b FAZ	24	15.48

4.4. Distribution According to Knowledge about Covid-19

According to the survey data, majority of students (n=942, 98.23%) identified the COVID-19 infection as a viral transmitted infection, identifying Bats (n=702, 73.20%) as the source of the disease. Furthermore, a good proportion of students were properly informed about the COVID-19 mode of transmission (Person-person 86%, Aerosol droplets 97%, Touching inanimate objects 60%, sharing dishes and cutleries 42%). And could also identify the incubation period (n=873, 91.03%) of COVID-19 to be 1-14 days. Also, a considerable proportion of students have Adequate knowledge about the symptoms (fever and high temperature 98%, coughing 96%, Fatigue 67%, sneezing 25%, painful throat 63%, headache 52%, and haemoptysis 5%) of COVID-19. 98.33%(n=943) of students reported that there is currently No vaccine available against the viral infection and they (n=884, 92.18%) will not travel to a country with an ongoing outbreak.

Table 5. Showing Distribution According to Knowledge about Covid-19

Level of Knowledge	Responses	Percentages (%)
Q7: In what group of microorganisms would you relate the causative agent of COVID-19?		
Other	2	<5
Bacteria	7	<5
Viruses	942	98.23
Fungi	1	<5
I don't know	7	<5
Q8: What was the origin of the COVID-19 Infection?		
Infected Bats	702	73.20
Bad Air	2	<5
Contaminated water/food	44	<5
wild animals	211	22.00

Table 5 Con't…

Level of Knowledge	Responses	Percentages (%)
Q10: How long does it take for you to present symptoms after being infected?		
1-14days	873	91.03
3-7days	86	8.97
Q12: Would you visit or call a doctor if you have similar symptoms stated above in Q11?		
Yes	736	76.75
No	223	23.25
Q13: Is COVID-19 Infection Treatable?		
Yes	245	25.55
No	641	66.84
I don´t know	73	7.61
Q14: Is there currently a vaccine against the COVID-19?		
Yes	2	<5
No	943	98.33
I don´t know	14	<5
Q15: would you go on vacation to a country with an ongoing outbreak?		
Yes	75	7.82
No	884	92.18

4.4.1. Distribution of multiple responses (Knowledge about Covid-19)

Table 5.1 Distribution of multiple responses (Knowledge about Covid-19)

Level of Knowledge	**Responses (N=959)**	**Percent-ages (%)**
Q9: How is COVID-19 transmitted?		
Person to person contact	828	86(%)
Aerosol droplets when an infected person cough or sneezes in the air	934	97(%)
Touching money, card terminals, smartphones, shopping trolley handles, door handles	577	60(%)
Dishes and cutlery in canteens and other places people eat together	399	42(%)
Q11: What are the symptoms of COVID-19?		
Fever with high temperature	942	98(%)
Sneezing	237	25(%)
Coughing	925	96(%)
Fatigue	642	67(%)
Headache	498	52(%)
Haemoptysis (blood in sputum)	49	5(%)
Painful throat	604	63(%)

Note: The percentage of each response reflects the total study sample(N=959) because each respondent had the possibility of choosing more than one option.

4.5. Distribution According to Perception about Covid-19

Survey data on students perception about Covid-19 reveals that 44.63% (n=428) were economically affected by the crisis, while a greater proportion of 55.37(n=531) was not. Majority of students incorporated new behavioural patterns into their routine daily hygiene practice such as: avoiding touching their faces, eyes, nose, or mouth when outdoors (n=477, 49.74%), covering of mouth and nostrils during coughing or sneezing (n=412, 42.96%), use of hand sanitisers (n=417, 43.48%), regular hand washing (n=854, 89.05%), and practising social distancing (n=633, 66.01%). To add, while a proportion of student (n=577, 60.17%) was worried about going to public or crowded places as it might increase the chances of getting in contact with an infected person, others agreed (n=540, 56.31%) or strongly agreed (n=280, 29.20%) to the fact that the German Government is taking enough measures to contain the pandemic thus making them feel less worried.

Table 6. Distribution According to Perception about Covid-19

Perception	Response	Percentage (%)
Q16: Has the current COVID-19 crisis affected your economic status?		
Yes	428	44.63
No	531	55.37
Q17: Are there measures you can implement on your normal lifestyle to prevent or limit the spread of the infection?		
Yes	905	94.37
No	54	5.63
Q18: I will avoid touching my face, eyes, nose, or mouth as far as I can		
Strongly Agree	477	49.74
Agree	420	43.80
Strongly disagree	15	<5
Disagree	47	<5

Table 6. Con't….

Perception	Response	Percentage (%)
Q19: I will cover my mouth and nose with a tissue when I cough or sneeze		
Strongly Agree	337	35.14
Agree	412	42.96
Strongly disagree	44	<5
Disagree	166	17.31
Q20: would you go on vacation to a country with an ongoing out-break?		
Strongly Agree	134	13.97
Agree	453	47.24
Strongly disagree	119	12.41
Disagree	253	26.38
Q21: It is important to use hand sanitisers		
Strongly Agree	246	25.65
Agree	417	43.48
Strongly disagree	99	10.32
Disagree	197	20.54

Table 6 Con't…

Perception	Response	Percentage (%)
Q22: It is important to wash hands regularly		
Strongly Agree	854	89.05
Agree	102	10.64
Strongly disagree	3	<5
Q23: It is important to practice social distancing		
Strongly Agree	633	66.01
Agree	285	29.72
Strongly disagree	18	<5
Disagree	23	<5
Q24: I will report a suspected case to the health authorities		
Strongly Agree	524	54.64
Agree	332	34.62
Strongly disagree	26	<5
Disagree	77	8.03
Q25: Are you worried that a member of your family could be infected?		
Yes	326	33.99
No	633	66.01
Q26: Are you worried that going to public or crowded places could increase the risk of you being infected?		
Yes	577	60.17
No	382	39.83

Table 6 Con't…

Perception	Response	Percentage (%)
Q27: Temporary closing down schools and workplaces is a good measure to prevent the spread of COVI-19		
Strongly Agree	590	61.52
Agree	319	33.26
Strongly disagree	18	<5
Disagree	32	<5
Q28: The German government has taken enough measures to control the COVID-19 pandemic		
Strongly Agree	280	29.20
Agree	540	56.31
Strongly disagree	59	6.15
Disagree	80	8.34
Q29: How would you classify the current ongoing COVID-19 crisis?		
Mild	23	<5
Moderate	139	14.49
Serious	429	44.73
Very serious	283	29.51
Scary	85	8.86
Q30: Do you still go out despite this crisis?		
No	828	86.34
Yes	131	13.66

4.6. Association between the Study Parameters (Source of Information, Knowledge and Perception).

4.6.1. Association between Source of Information and Perception about COVID-19.

Overall results suggest that the perception of COVID-19 was impacted by the source of information. Hence, respondents with a reliable source of information were more likely to have a positive perception of COVID-19 compared to respondents with a less reliable source of information.

Table7 reports that 590 (80%) respondents with a reliable source of information are more likely to agree or strongly agree to cover their mouth when coughing or sneezing (Q19) compared to 159(72%) respondents with a non-reliable source of information. And this finding is statistically significant (p=0.015).

Amongst other significant findings, the use of face mask (Q20) (p=0.003), regular handwashing (p=0.002), reporting a case (p=0.009) or going to the public (p=0.012).

The source of information did not seem to be impactful on the COVID-19 perception when assessing economic status (p=0.396), use of hand sanitisers (p=0.928), worried about a family member being infected(p=0.155), school closure (p=0.188), German government taking enough measures (p=0.091)

Table 7. Association between Source of Information and Perception about covid-19.

	Reliable sources of information about covid-19 N (%)	Non-Reliable source of information about covid-19 N (%)	p-value
Q16			**0.396**
Yes	334 (45)	94 (42)	
No	402 (55)	129 (58)	
Q19			**0.015**
Strongly Agree	273 (37)	64 (29)	
Agree	317 (43)	95 (43)	
Strongly Disagree	33 (4)	11 (5)	
Disagree	113 (15)	53 (24)	
Q20			**0.003**
Strongly Agree	111 (15)	23 (10)	
Agree	363 (49)	90 (40)	
Strongly Disagree	82 (11)	37 (17)	
Disagree	180 (24)	73 (33)	
Q21			**0.928**
Strongly Agree	192 (26)	54 (24)	
Agree	317 (43)	100 (45)	
Strongly Disagree	77 (10)	22 (10)	
Disagree	150 (20)	47 (21)	

Table 7 Con't…

	Reliable sources of information about covid-19 N (%)	Non-Reliable source of information about covid-19 N (%)	p-value
Q22			**0.002**
Strongly Agree	670 (91)	184 (83)	
Agree	64 (9)	38 (17)	
Strongly Disagree	2 (<1)	1 (<1)	
Q23			**0.023**
Strongly Agree	503 (68)	130 (58)	
Agree	207 (28)	78 (35)	
Strongly Disagree	11 (1)	7 (3)	
Disagree	15 (2)	8 (4)	
Q24			**0.009**
Strongly Agree	412 (56)	112 (50)	
Agree	257 (35)	75 (34)	
Strongly Disagree	14 (2)	12 (5)	
Disagree	53 (7)	24 (11)	
Q25			**0.155**
Yes	259 (35)	67 (30)	
No	477 (65)	156 (70)	
Q26			**0.012**
Yes	459 (62)	118 (53)	
No	277 (38)	105 (47)	

Table 7 Con't…

	Reliable sources of information about covid-19 N (%)	Non-Reliable source of information about covid-19 N (%)	p-value
Q27			**0.188**
Strongly Agree	464 (63)	126 (57)	
Agree	237 (32)	82 (37)	
Strongly Disagree	11 (1)	7 (3)	
Disagree	24 (3)	8 (4)	
Q28			**0.091**
Strongly Agree	208 (28)	72 (32)	
Agree	410 (56)	130 (58)	
Strongly Disagree	51 (7)	8 (4)	
Disagree	67 (9)	13 (6)	

4.6.2 Association between Knowledge and Source of information about COVID-19.

A general overview of the analysis suggests that the knowledge about COVID-19 was not impacted by the source of information. Hence, respondents with reliable sources of information were equally likely to be knowledgeable about COVID-19 compared to respondents with non-reliable sources of information.

Table 8 reports that 726 (77%) respondents who were knowledgeable about COVID-19 causative agent(Q7) were equally like to get their information from a reliable source compared to 216 (23%) respondents who got their information from a non-reliable source of information. This finding is statistically insignificant (p=0.078).

Amongst other insignificant findings, knowledge about the Reservoir host (Q8) (p=0.914), knowledge about the mode of transmission(Q9)(p=0.069), knowledge about the Incubation period (Q10)(p=0.423) etc.

Table 8. Association between Knowledge and Source of information about covid-19.

	Reliable sources of information about covid-19 N (%)	Non-Reliable source of information about covid-19 N (%)	p-value
Q7			**0.078**
Knowledgeable about covid-19 Causative Agent	726 (77)	216 (23)	
Not Knowledgeable about covid-19 Causative Agent	10 (59)	7 (41)	
Q8			**0.914**
Knowledgeable about covid-19 Reservoir host	701 (77)	212 (23)	
Not Knowledgeable about covid-19 Reservoir host	35 (76)	11 (24)	
Q9			**0.069**
Knowledgeable about the covid-19 mode of transmission	736 (77)	222 (23)	
Not Knowledgeable about the covid-19 mode of transmission	0	1 (100)	

Table 8. Con't…

	Reliable sources of information about covid-19 N (%)	Non-Reliable source of information about covid-19 N (%)	p-value
Q10			**0.423**
Knowledgeable about covid-19 Incubation period	667 (76)	206 (24)	
Not Knowledgeable about covid-19 Incubation period	69 (80)	17 (20)	
Q11			**0.078**
Knowledgeable about Symptoms of covid-19	726 (77)	216 (23)	
Not Knowledgeable about Symptoms of covid-19	10 (59)	7 (41)	
Q14			**0.174**
Knowledgeable about covid-19 vaccine availability	726 (77)	217 (23)	
Not Knowledgeable about covid-19 vaccine availability	10 (63)	6 (38)	
Q15			**0.194**
Knowledgeable about covid-19 travel restrictions	683 (77)	201 (23)	
Not Knowledgeable about covid-19 travel restrictions	53 (71)	22 (29)	

4.6.3 Association between Perception and Knowledge Parameters about covid-19.

4.6.3.1 Association between Knowledge (Q7: Causative Agent) and Perception about covid-19.

The overall analysis reveals that the perception of respondents was not impacted by the knowledge parameters about the causative agent of COVID-19. Hence, knowledgeable respondents were equally likely to have a positive/negative perception of covid-19 compared to the non-knowledgeable respondent.

Table 9 delineates that, 736(78%) respondents who agreed or strongly agreed to cover their mouth when coughing or sneezing(Q19) were equally likely to be knowledgeable about the causative agent of COVID-19 compared to 13(76%) respondents who also agreed or strongly agreed to cover their mouth when coughing or sneezing but were not knowledgeable about the causative agent of COVID-19. And this finding is statistically insignificant ($p=0.923$), therefore the difference in proportions(78% versus 76%) is purely chanced. Similar findings are seen in the association between perception and other knowledge parameters(see Table 10-15 in the Appendix).

Amongst other insignificant findings, the use of face mask (Q20) ($p=0.162$), the use of hand sanitisers (Q21)($p=0.282$), regular handwashing(Q22)($p=0.216$), practising social distance (Q23)($p=0.114$) or worried about a family member being infected (Q25)($p=0.251$).

On the other hand, the perception of respondents was impacted by the knowledge about the causative agent of COVID-19 when assessing the reporting of a suspected case to the health authorities(Q24)($p<0.001$) and temporally closing schools or workplaces (Q27)($p=0.022$).

Table 9. Association between Knowledge (Q7: Causative Agent) and Perception about covid-19.

	Knowledgeable about covid-19 Causative Agent N (%)	Non-Knowledgeable about covid-19 Causative Agent N (%)	p-value
Q16			**0.839**
Yes	420 (45)	8 (47)	
No	522 (55)	9 (53)	
Q19			**0.923**
Strongly Agree	330 (35)	7 (41)	
Agree	406 (43)	6 (35)	
Strongly Disagree	43 (5)	1 (6)	
Disagree	163 (17)	3 (18)	
Q20			**0.162**
Strongly Agree	133 (14)	1 (6)	
Agree	448 (48)	5 (29)	
Strongly Disagree	115 (12)	4 (24)	
Disagree	246 (26)	7 (41)	

Table 9. Con't….

	Knowledgeable about covid-19 Causative Agent N (%)	Non-Knowledgeable about covid-19 Causative Agent N (%)	p-value
Q21			**0.282**
Strongly Agree	239 (25)	7 (41)	
Agree	409 (43)	8 (47)	
Strongly Disagree	98 (10)	1 (6)	
Disagree	196 (21)	1 (6)	
Q22			**0.216**
Strongly Agree	841 (89)	13 (76)	
Agree	98 (10)	4 (24)	
Strongly Disagree	3 (<1)	0	
Q23			**0.114**
Strongly Agree	626 (66)	7 (41)	
Agree	276 (29)	9 (53)	
Strongly Disagree	18 (2)	0	
Disagree	22 (2)	1 (6)	

Table 9. Con't….

	Knowledgeable about covid-19 Causative Agent N (%)	Non-Knowledgeable about covid-19 Causative Agent N (%)	p-value
Q24			**<0.001**
Strongly Agree	520 (55)	4 (24)	
Agree	325 (35)	7 (41)	
Strongly Disagree	23 (2)	3 (18)	
Disagree	74 (8)	3 (18)	
Q25			**0.251**
Yes	318 (34)	8 (47)	
No	624 (66)	9 (53)	
Q26			**0.700**
Yes	566 (60)	11 (65)	
No	376 (40)	6 (35)	
Q27			**0.022**
Strongly Agree	581 (62)	9 (53)	
Agree	314 (33)	5 (29)	
Strongly Disagree	16 (2)	2 (12)	
Disagree	31 (3)	1 (6)	
Q28			**0.911**
Strongly Agree	276 (29)	4 (24)	
Agree	529 (56)	11 (65)	
Strongly Disagree	58 (6)	1 (6)	
Disagree	79(8)	1(6)	

4.7 DISCUSSION OF THE STUDY

COVID-19 infection is currently a global topic of concern both in the media and among the public due to its high spreading rate, with the aged and immunocompromised individuals being more vulnerable to the infection, and differential recovery rates in different countries (40, 42). Presently, the number of infected individuals continue to increase mounting tensions on Governments, medical personnel and the public and an important question arises regarding how information about COVID-19 is being managed to mitigate the pandemic(40). As a result, we assessed knowledge, perception, and source of information about COVID-19 among HAW-Hamburg students.

Although knowledge and perception vary among different groups and levels of students, the result of this study reveals that majority of students had good knowledge about COVID-19 infection and its mode of transmission(Table 5) and an overall positive perception about the transmission and prevention of COVID-19 which is in line with a study conducted by Bhagavathula and co among health care workers(HCWs)(42). The findings also show that 65.1% of students relied on TV stations and 57.7% from national health website like Robert-Koch Institute for information about COVID-19 as their primary source of information. This, therefore, confirms the credibility and transparency of COVID-related information constantly posted on TV stations and national health websites by the government health authorities. This constant COVID-19-related updates had positive implications for improving student's knowledge and perception about COVID-19 transmission.

Nevertheless, a finding of great concern is that 46.2% of students depended on social media as their source of information. Misinformation and infodemics remain a general public concern due to the availability of a vast diversity of information available through the internet and unverified malicious information which can spread rapidly misguiding the population. For these reasons, health authorities and scientist have warned against the widespread of misinformation about COVID-19 which is currently causing xenophobia worldwide(42,43). As a result, students should critically evaluate COVID-19-related information by using reliable and scientific or evident-based information channels as information sources.

The outcomes of this study reveal an overall non-significant association between student´s knowledge about COVID-19 and the source of information. This explains the fact that most students depended not only on one source of information to be informed about the pandemic.

The overall results of the association between the source of information and perception elucidate that, the perception about COVID-19 was impacted by the source of information. Hence, respondents with reliable sources of information were more likely to be aware of covid-19 compared to respondents with a less reliable source of information. For instance, results in Table7 shows that 590 (80%) respondents with reliable sources of information are more likely to cover their mouth when coughing or sneezing compared to 159(72%) respondents with non-reliable sources of information. And this finding is statistically significant (p=0.015).

On the other hand, a general overview of the analysis of the association between knowledge and source of information suggests that the knowledge about COVID-19 was not impacted by the source of information. Hence, respondents with a reliable source of information were equally likely to be knowledgeable about COVID-19 compared to respondents with non-reliable sources of information. For example, Table 8 reports that 726 (77%) respondents who were knowledgeable about COVID-19 causative agent were equally like to get their information from a reliable source compared to 216 (23%) respondents who got their information from a non-reliable source of information. This finding is statistically insignificant (p=0.078).

Finally, an overall analysis of the association between perception and knowledge parameters(e.g., the causative agent of COVID-19) reveals that the perception of respondents was not impacted by their knowledge about COVID-19. Hence, knowledgeable respondents were equally likely to have a positive/negative perception of COVID-19 compared to the non-knowledgeable respondent. For instance, the association between perception and knowledge of causative agent of COVID-19(Table 9) delineates that, 736(78%) respondents who agreed or strongly agreed to cover their mouth when coughing or sneezing were equally likely to be knowledgeable about the causative agent of COVID-19 compared to 13(76%) who equally agreed or strongly agreed to cover their mouth when coughing or sneezing but were not knowledgeable about the causative agent of COVID-19. And this finding is statistically insignificant (p=0.923).

CHAPTER FIVE

5.0. CONCLUSION, RECOMMENDATION, AND LIMITATION OF THE STUDY

5.1. Conclusion

The study reveals that the protective actions taken by individuals against COVID-19 are influenced by their source of information. Thus, the need to widen reliable sources of information becomes an issue of national concern. Another finding of great concern is that 46.2% of students depended on social media as their source of information about COVID-19. This could be a potential opening for the spread of misinformation or infodemics.

5.2. Recommendation

As COVID-19 continues to emerge and pose a global threat which can lead to mass panic, policies should be put in place to verify the authenticity of all media (information channels) leveraging information about COVID-19. Furthermore, greater efforts through educational campaigns that target the spread of infodemic are urgently needed.

Further studies should be conducted to investigate the different social media channels as students source of information about COVID-19 and the spread of fake news.

5.3. LIMITATION OF THE STUDY

This study is not without limitations.

- The information derived from the survey was self-reported and partly depended on participants honesty which might be prone to recall bias.
- Furthermore, the study was conducted among HAW Hamburg students. This could limit the generalization of findings to settings.
- Another important limitation to consider is that all identified parameters of concerns cannot be interpreted beyond general association.

However, despite these limitations, the findings of this study provide valuable information about the knowledge, perception, and source of information of HAW Hamburg students about COVID-19 during a peak period of the pandemic.

QUESTIONNAIRES

Appendix

Table 10. Association between Knowledge (Q8: Reservoir host) and Perception about covid-19.

	Knowledgeable about Reservoir host of covid-19 N (%)	Non-Knowledgeable about Reservoir host of covid-19 N (%)	p-value
Q16			**0.642**
Yes	409 (45)	19 (41)	
No	504 (55)	27 (59)	
Q19			**0.143**
Strongly Agree	325 (36)	12 (26)	
Agree	392 (43)	20 (43)	
Strongly Disagree	39 (4)	5 (11)	
Disagree	157 (17)	9 (20)	
Q20			**0.586**
Strongly Agree	130 (14)	4 (9)	
Agree	431 (47)	22 (48)	
Strongly Disagree	111 (12)	8 (17)	
Disagree	241 (26)	12 (26)	

Table 10. Con't…

	Knowledgeable about Reservoir host of covid-19 N (%)	Non-Knowledgeable about Reservoir host of covid-19 N (%)	p-value
Q21			**0.736**
Strongly Agree	232 (25)	14 (30)	
Agree	400 (44)	17 (37)	
Strongly Disagree	93 (10)	6 (13)	
Disagree	188 (21)	9 (20)	
Q22			**<0.001**
Strongly Agree	814 (89)	40 (87)	
Agree	98 (11)	4 (9)	
Strongly Disagree	1 (<1)	(4)	
Q23			**0.005**
Strongly Agree	602 (66)	31 (67)	
Agree	275 (30)	10 (22)	
Strongly Disagree	14 (2)	4 (9)	
Disagree	22 (2)	1 (2)	

Table 10. Con't…

			P-Value
Q24			**0.006**
Strongly Agree	502 (55)	22 (48)	
Agree	316 (35)	16 (35)	
Strongly Disagree	21 (2)	5 (11)	
Disagree	74 (8)	3 (7)	
Q25			**0.072**
Yes	316 (35)	10 (22)	
No	597 (65)	36 (78)	
Q26			**0.605**
Yes	551 (60)	26 (57)	
No	362 (40)	20 (43)	
Q27			**0.116**
Strongly Agree	564 (62)	26 (57)	
Agree	304 (33)	15 (33)	
Strongly Disagree	15 (2)	3 (7)	
Disagree	30 (3)	2 (4)	
Q28			**0.072**
Strongly Agree	267 (29)	13 (28)	
Agree	517 (57)	23 (50)	
Strongly Disagree	52 (6)	7 (15)	
Disagree	77(8)	1(7)	

Table 11. Association between Knowledge (Q9: Mode of transmission) and Perception about covid-19.

	Knowledgeable about the mode of transmission of covid-19 N (%)	Non-Knowledgeable about the mode of transmission of covid-19 N (%)	p-value
Q16			**0.369**
Yes	428 (45)	0	
No	530 (55)	1 (100)	
Q19			**<0.001**
Strongly Agree	337 (35)	0	
Agree	412 (43)	0	
Strongly Disa-gree	43 (4)	1 (100)	
Disagree	166 (17)	0	
Q20			**0.070**
Strongly Agree	134 (14)	0	
Agree	453 (47)	0	
Strongly Disa-gree	118 (12)	1 (100)	
Disagree	253 (26)	0	
Q21			**0.034**
Strongly Agree	246 (26)	0	
Agree	417 (44)	0	
Strongly Disa-gree	98 (10)	1 (100)	
Disagree	197 (21)	0	

Table 11. Con't…

	Knowledgeable about Reservoir host of covid-19 N (%)	Non-Knowledgeable about Reservoir host of covid-19 N (%)	p-value
Q22			**<0.001**
Strongly Agree	854 (89)	0	
Agree	102 (11)	0	
Strongly Disagree	2 (<1)	1 (100)	
Q23			**<0.001**
Strongly Agree	633 (66)	0	
Agree	285 (30)	0	
Strongly Disagree	17 (2)	1 (100)	
Disagree	23 (2)	0	
Q24			**<0.001**
Strongly Agree	524 (55)	0	
Agree	332 (35)	0	
Strongly Disagree	25 (3)	1 (100)	
Disagree	77 (8)	0	
Q25			**0.473**
Yes	326 (34)	0	
No	632 (66)	1 (100)	

Table 11. Con't…

	Knowledgeable about Reservoir host of covid-19 N (%)	Non-Knowledgeable about Reservoir host of covid-19 N (%)	p-value
Q26			**0.219**
Yes	577 (60)	0	
No	381 (40)	1 (100)	
Q27			**<0.001**
Strongly Agree	590 (62)	0	
Agree	319 (33)	0	
Strongly Disagree	17 (2)	1 (100)	
Disagree	32 (3)	0	
Q28			**0.002**
Strongly Agree	280 (29)	0	
Agree	540 (56)	0	
Strongly Disagree	58 (6)	1 (100)	
Disagree	80 8)	0	

Table 12. Association between Knowledge (Q10: Incubation period) and Perception about covid-19.

	Knowledgeable about the covid-19 Incubation period N (%)	Non-Knowledgeable about the covid-19 Incubation period N (%)	p-value
Q16			**0.411**
Yes	386 (44)	42 (49)	
No	487 (56)	44 (51)	
Q19			**0.492**
Strongly Agree	308 (35)	29 (34)	
Agree	379 (43)	33 (38)	
Strongly Disagree	38 (4)	6 (7)	
Disagree	148 (17)	18 (21)	
Q20			**0.312**
Strongly Agree	125 (14)	9 (10)	
Agree	410 (47)	43 (50)	
Strongly Disagree	104 (12)	15 (17)	
Disagree	234 (27)	19 (22)	
Q21			**0.263**
Strongly Agree	231 (26)	15 (17)	
Agree	374 (43)	43 (50)	
Strongly Disagree	88 (10)	11 (13)	
Disagree	180 (21)	17 (20)	

Table 12. Con't…

	Knowledgeable about the Incubation period of covid-19 N (%)	Non-Knowledgeable about the Incubation period of covid-19 N (%)	p-value
Q22			**0.860**
Strongly Agree	777 (89)	77 (90)	
Agree	93 (11)	9 (10)	
Strongly Disagree	3 (<1)	0	
Q23			**0.442**
Strongly Agree	580 (66)	53 (62)	
Agree	256 (29)	29 (34)	
Strongly Disagree	15 (2)	3 (3)	
Disagree	22 (3)	1 (1)	
Q24			**0.004**
Strongly Agree	493 (56)	31 (36)	
Agree	290 (33)	42 (49)	
Strongly Disagree	23 (3)	3 (3)	
Disagree	67 (8)	10 (12)	
Q25			**0.212**
Yes	302 (35)	24 (28)	
No	571 (65)	62 (72)	
Q26			**0.074**
Yes	533 (61)	44 (51)	
No	340 (39)	42 (49)	

Table 12. Con't…

	Knowledgeable about the Incubation period of covid-19 N (%)	Non-Knowledgeable about the Incubation period of covid-19 N (%)	p-value
Q27			**0.786**
Strongly Agree	539 (62)	51 (59)	
Agree	287 (33)	32 (37)	
Strongly Disagree	17 (2)	1 (1)	
Disagree	30 (3)	2 (2)	
Q28			**0.410**
Strongly Agree	252 (29)	28 (33)	
Agree	490 (56)	50 (58)	
Strongly Disagree	57 (7)	2 (2)	
Disagree	74 (8)	6 (7)	

Table 13. Association between Knowledge (Q11: Symptoms) and Perception about covid-19.

	Knowledgeable about symptoms of covid-19 N (%)	Non-Knowledgeable about symptoms of covid-19 N (%)	p-value
Q16			**0.077**
Yes	424 (45)	4 (24)	
No	518 (55)	13 (76)	
Q19			**0.435**
Strongly Agree	332 (35)	5 (29)	
Agree	406 (43)	6 (35)	
Strongly Disagree	42 (4)	2 (12)	
Disagree	162 (17)	4 (24)	
Q20			**0.143**
Strongly Agree	133 (14)	1 (6)	
Agree	447 (47)	6 (35)	
Strongly Disagree	114 (12)	5 (29)	
Disagree	248 (26)	5 (29)	
Q21			**0.699**
Strongly Agree	243 (26)	3 (18)	
Agree	410 (44)	7 (41)	
Strongly Disagree	96 (10)	3 (18)	
Disagree	193 (20)	4 (24)	

Table 13. Con't…

	Knowledgeable about symptoms of covid-19 N (%)	Non-Knowledgeable about symptoms of covid-19 N (%)	p-value
Q22			**<0.001**
Strongly Agree	841 (89)	13 (76)	
Agree	99 (11)	3 (18)	
Strongly Disagree	2 (<1)	(6)	
Q23			**0.205**
Strongly Agree	625 (66)	8 (47)	
Agree	277 (29)	8 (47)	
Strongly Disagree	17 (2)	1 (6)	
Disagree	23 (2)	0	
Q24			**0.780**
Strongly Agree	515 (55)	9 (53)	
Agree	327 (35)	5 (29)	
Strongly Disagree	25 (3)	1 (6)	
Disagree	75 (8)	2 (12)	
Q25			**0.051**
Yes	324 (34)	2 (12)	
No	618 (66)	15 (88)	
Q26			**0.265**
Yes	569 (60)	8 (47)	
No	373 (40)	9 (53)	

Table 13. Con't…

	Knowledgeable about symptoms of covid-19 N (%)	Non-Knowledgeable about symptoms of covid-19 N (%)	p-value
Q27			**0.591**
Strongly Agree	580 (62)	10 (59)	
Agree	314 (33)	5 (29)	
Strongly Disagree	17 (2)	1 (6)	
Disagree	31 (3)	1 (6)	
Q28			**0.158**
Strongly Agree	275 (29)	5 (29)	
Agree	531 (56)	9 (53)	
Strongly Disagree	56 (6)	3 (18)	
Disagree	80 (8)	0	

Table 14. Association between Knowledge (Q14: Vaccine availability) and Perception about covid-19.

	Knowledgeable about covid-19 vaccine N (%)	Non-Knowledgeable about covid-19 vaccine N (%)	p-value
Q16			**0.014**
Yes	416 (44)	12 (75)	
No	527 (56)	4 (25)	
Q19			**0.031**
Strongly Agree	330 (35)	7 (44)	
Agree	408 (43)	4 (25)	
Strongly Disagree	41 (4)	3 (19)	
Disagree	164 (17)	2 (13)	
Q20			**0.055**
Strongly Agree	129 (14)	5 (31)	
Agree	449 (48)	4 (25)	
Strongly Disagree	115 (12)	4 (25)	
Disagree	250 (27)	3 (19)	
Q21			**0.358**
Strongly Agree	239 (25)	7 (44)	
Agree	412 (44)	5 (31)	
Strongly Disagree	97 (10)	2 (13)	
Disagree	195 (21)	2 (13)	

Table 14. Con't…

	Knowledgeable about vaccine of covid-19 N (%)	Non-Knowledgeable about vaccine of covid-19 N (%)	p-value
Q22			**0.557**
Strongly Agree	841 (89)	13 (81)	
Agree	99 (10)	3 (19)	
Strongly Disagree	(<1)	0	
Q23			**<0.001**
Strongly Agree	625 (66)	8 (50)	
Agree	280 (30)	5 (31)	
Strongly Disagree	15 (2)	3 (19)	
Disagree	23 (2)	0	
Q24			**0.100**
Strongly Agree	515 (55)	9 (56)	
Agree	328 (35)	4 (25)	
Strongly Disagree	24 (3)	2 (13)	
Disagree	76 (8)	1 (6)	
Q25			**0.765**
Yes	320 (34)	6 (38)	
No	623 (66)	10 (63)	
Q26			**0.222**
Yes	565 (60)	12 (75)	
No	378 (40)	4 (25)	

Table 14. Con't…

	Knowledgeable about vaccine of covid-19 N (%)	Non-Knowledgeable about vaccine of covid-19 N (%)	p-value
Q27			**0.046**
Strongly Agree	579 (61)	11 (69)	
Agree	317 (34)	2 (13)	
Strongly Disagree	17 (2)	1 (6)	
Disagree	30 (3)	2 (13)	
Q28			**0.018**
Strongly Agree	276 (29)	4 (25)	
Agree	533 (57)	7 (44)	
Strongly Disagree	55 (6)	4 (25)	
Disagree	79 (8)	1 (6)	

Table 15. Association between Knowledge (Q15: Travel restrictions) and Perception about covid-19.

	Knowledgeable about travelling restrictions during the covid-19 pandemic N (%)	Non-Knowledgeable about travelling restrictions during the covid-19 pandemic N (%)	p-value
Q16			**0.039**
Yes	386 (44)	42 (56)	
No	498 (56)	33 (44)	
Q19			**<0.001**
Strongly Agree	324 (37)	13 (17)	
Agree	381 (43)	31 (41)	
Strongly Disagree	38 (4)	6 (8)	
Disagree	141 (16)	25 (33)	
Q20			**<0.001**
Strongly Agree	127 (14)	7 (9)	
Agree	435 (49)	18 (24)	
Strongly Disagree	102 (12)	17 (23)	
Disagree	220 (25)	33 (44)	

Table 15. Con't…

	Knowledgeable about travelling restrictions of covid-19 N (%)	Non-Knowledgeable about travelling restrictions of covid-19 N (%)	p-value
Q21			**<0.001**
Strongly Agree	239 (27)	7 (9)	
Agree	392 (44)	25 (33)	
Strongly Disagree	79 (9)	20 (27)	
Disagree	174 (20)	23 (31)	
Q22			**<0.001**
Strongly Agree	800 (90)	54 (72)	
Agree	82 (9)	20 (27)	
Strongly Disagree	2 (<1)	(1)	
Q23			**<0.001**
Strongly Agree	609 (69)	24 (32)	
Agree	258 (29)	27 (36)	
Strongly Disagree	10 (1)	8 (11)	
Disagree	7 (<1)	16 (21)	
Q24			**<0.001**
Strongly Agree	498 (56)	26 (35)	
Agree	308 (35)	24 (32)	
Strongly Disagree	15 (2)	11 (15)	
Disagree	63 (7)	14 (19)	

Table 15. Con't…

	Knowledgeable about travelling restrictions of covid-19 N (%)	Non-Knowledgeable about travelling restrictions of covid-19 N (%)	p-value
Q25			**0.057**
Yes	308 (35)	18 (24)	
No	576 (65)	57 (76)	
Q26			**<0.001**
Yes	559 (63)	18 (24)	
No	325 (37)	57 (76)	
Q27			**<0.001**
Strongly Agree	565 (64)	25 (33)	
Agree	290 (33)	29 (39)	
Strongly Disagree	9 (1)	9 (12)	
Disagree	20 (2)	12 (16)	
Q28			**0.002**
Strongly Agree	255 (29)	25 (33)	
Agree	511 (58)	29 (39)	
Strongly Disagree	50 (6)	9 (12)	
Disagree	68 (8)	12 (16)	

REFERENCES

1. Wu D, Wu T, Liu Q, Yang Z. The SARS-CoV-2 outbreak: what we know. Int J Infect Dis. 2020 Mar 11;

2. Cui J, Li F, Shi Z-L. Origin and evolution of pathogenic coronaviruses. Nat Rev Microbiol [Internet]. 2019 [cited 2020 Apr 4];17(3):181–92. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7097006/

3. Guo Y-R, Cao Q-D, Hong Z-S, Tan Y-Y, Chen S-D, Jin H-J, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. Mil Med Res. 2020 13;7(1):11.

4. Chan JF-W, Kok K-H, Zhu Z, Chu H, To KK-W, Yuan S, et al. Genomic characterization of the 2019 novel human-pathogenic coronavirus isolated from a patient with atypical pneumonia after visiting Wuhan. Emerg Microbes Infect [Internet]. 2020 Jan 28 [cited 2020 Apr 4];9(1):221–36. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7067204/

5. Cheng VCC, Lau SKP, Woo PCY, Yuen KY. Severe Acute Respiratory Syndrome Coronavirus as an Agent of Emerging and Reemerging Infection. CMR [Internet]. 2007 Oct [cited 2020 Apr 17];20(4):660–94. Available from: https://CMR.asm.org/content/20/4/660

6. AlAjaji AAAAAAHAAKSANSAEYMWSA. Knowledge and Attitude of secondary school students in Sudair area, Saudi Arabia about Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Majmaah Journal of Health Sciences [Internet]. 2017 [cited 2020 Mar 23];5(2):76–86. Available from: http://www.mjhs-mu.org/index.php?mno=294060

7. Abbag HF, El-Mekki AA, Al Bshabshe AAA, Mahfouz AA, Al-Dosry AA, Mirdad RT, et al. Knowledge and attitude towards the Middle East respiratory syndrome coronavirus among healthcare personnel in the southern region of Saudi Arabia. Journal of Infection and Public Health [Internet]. 2018 Sep 1 [cited 2020 Mar 21];11(5):720–2. Available from: http://www.sciencedirect.com/science/article/pii/S1876034118300261

8. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. New England Journal of Medicine [Internet]. 2020 Feb 20 [cited 2020 Apr 4];382(8):727–33. Available from: https://doi.org/10.1056/NEJMoa2001017

9. Ralph R, Lew J, Zeng T, Francis M, Xue B, Roux M, et al. 2019-nCoV (Wuhan virus), a novel Coronavirus: human-to-human transmission, travel-related cases, and vaccine readiness. J Infect Dev Ctries. 2020 31;14(1):3–17.

10. Stoecklin SB, Rolland P, Silue Y, Mailles A, Campese C, Simondon A, et al. First cases of coronavirus disease 2019 (COVID-19) in France: surveillance, investigations and control measures, January 2020. Eurosurveillance [Internet]. 2020 Feb 13 [cited 2020 Apr 19];25(6):2000094. Available from: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.6.2000094

11. Jin Y-H, Cai L, Cheng Z-S, Cheng H, Deng T, Fan Y-P, et al. A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version). Mil Med Res. 2020 06;7(1):4.

12. Spiteri G, Fielding J, Diercke M, Campese C, Enouf V, Gaymard A, et al. First cases of coronavirus disease 2019 (COVID-19) in the WHO European Region, 24 January to 21 February 2020. Euro Surveill. 2020;25(9).

13. WHO situational report 86.

https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200415-sitrep-86-covid-19.pdf?sfvrsn=c615ea20_2

14. Zhou C, Su F, Pei T, Zhang A, Du Y, Luo B, et al. COVID-19: Challenges to GIS with Big Data. Geography and Sustainability [Internet]. 2020 Mar 20 [cited 2020 Mar 23]; Available from: http://www.sciencedirect.com/science/article/pii/S2666683920300092

15. Malik YS, Sircar S, Bhat S, Sharun K, Dhama K, Dadar M, et al. Emerging novel coronavirus (2019-nCoV)—current scenario, evolutionary perspective based on genome analysis and recent developments. Vet Q [Internet]. 2020 Feb 27 [cited 2020 Apr 19];40(1):68–76. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7054940/

16. Banerjee A, Kulcsar K, Misra V, Frieman M, Mossman K. Bats and Coronaviruses. Viruses [Internet]. 2019 Jan 9 [cited 2020 Apr 20];11(1). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6356540/

17. Lam TT-Y, Shum MH-H, Zhu H-C, Tong Y-G, Ni X-B, Liao Y-S, et al. Identification of 2019-nCoV related coronaviruses in Malayan pangolins in southern China. bioRxiv [Internet]. 2020 Feb 18 [cited 2020 Apr 20];2020.02.13.945485. Available from: https://www.biorxiv.org/content/10.1101/2020.02.13.945485v1

18. Ge X-Y, Li J-L, Yang X-L, Chmura AA, Zhu G, Epstein JH, et al. Isolation and characterization of a bat SARS-like coronavirus that uses the ACE2 receptor. Nature [Internet]. 2013 [cited 2020 Apr 20];503(7477):535–8. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5389864/

19. Hu B, Zeng L-P, Yang X-L, Ge X-Y, Zhang W, Li B, et al. Discovery of a rich gene pool of bat SARS-related coronaviruses provides new insights into the origin of SARS coronavirus. PLOS Pathogens [Internet]. 2017 Nov 30 [cited 2020 Apr 20];13(11):e1006698. Available from: https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1006698

20. Zhou P, Yang X-L, Wang X-G, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature [Internet]. 2020 [cited 2020 Apr 20];579(7798):270–3. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7095418/

21. Perlman S. Another Decade, Another Coronavirus. New England Journal of Medicine [Internet]. 2020 Feb 20 [cited 2020 Apr 20];382(8):760–2. Available from: https://doi.org/10.1056/NEJMe2001126

22. Chan JF-W, Yuan S, Kok K-H, To KK-W, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020 15;395(10223):514–23.

23. Phelan AL, Katz R, Gostin LO. The Novel Coronavirus Originating in Wuhan, China: Challenges for Global Health Governance. JAMA [Internet]. 2020 Feb 25 [cited 2020 Apr21];323(8):709–10.Availablefrom: https://jamanetwork.com/journals/jama/fullarticle/2760500

24. Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations [Internet]. [cited 2020 Apr 21]. Available from: https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations

25. WHO Q&A on coronaviruses (COVID-19).

https://www.who.int/news-room/q-a-detail/q-a-coronaviruses

26. Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al. First Case of 2019 Novel Coronavirus in the United States. New England Journal of Medicine [Internet]. 2020 Mar 5 [cited 2020 Apr 21];382(10):929–36. Available from: https://doi.org/10.1056/NEJMoa2001191

27. Yang H, Wang C, Poon LC. Novel coronavirus infection and pregnancy. Ultrasound in Obstetrics & Gynecology [Internet]. 2020 [cited 2020 Apr 21];55(4):435–7. Available from: https://obgyn.onlinelibrary.wiley.com/doi/abs/10.1002/uog.22006

28. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect [Internet]. 2020 Mar [cited 2020 Apr 22];104(3):246–51. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7132493/

29. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. Int J Oral Sci. 2020 03;12(1):9.

30. Otter JA, Donskey C, Yezli S, Douthwaite S, Goldenberg SD, Weber DJ. Transmission of SARS and MERS coronaviruses and influenza virus in healthcare settings: the possible role of dry surface contamination. Journal of Hospital Infection [Internet]. 2016 Mar 1 [cited 2020 Apr 22];92(3):235–50. Available from: http://www.sciencedirect.com/science/article/pii/S0195670115003679

31. Shen K, Yang Y, Wang T, Zhao D, Jiang Y, Jin R, et al. Diagnosis, treatment, and prevention of 2019 novel coronavirus infection in children: experts' consensus statement. World J Pediatr [Internet]. 2020 Feb 7 [cited 2020 Apr 21]; Available from: https://doi.org/10.1007/s12519-020-00343-7

32. Adhikari SP, Meng S, Wu Y-J, Mao Y-P, Ye R-X, Wang Q-Z, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. Infect Dis Poverty. 2020 Mar 17;9(1):29.

33. Yu F, Du L, Ojcius DM, Pan C, Jiang S. Measures for diagnosing and treating infections by a novel coronavirus responsible for a pneumonia outbreak originating in Wuhan, China. Microbes Infect [Internet]. 2020 Mar [cited 2020 Apr 22];22(2):74–9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7102556/

34. WHO situational report 99.

https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200428-sitrep-99-covid-19.pdf?sfvrsn=119fc381_2

35. WHO situational report 100.

https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200429-sitrep-100-covid-19.pdf?sfvrsn=bbfbf3d1_6

36. Leung GM, Leung K. Crowdsourcing data to mitigate epidemics. The Lancet Digital Health [Internet]. 2020 Feb 20 [cited 2020 Mar 23]; Available from: http://www.sciencedirect.com/science/article/pii/S2589750020300558

37. Cinelli M, Quattrociocchi W, Galeazzi A, Valensise CM, Brugnoli E, Schmidt AL, et al. The COVID-19 Social Media Infodemic. arXiv:200305004 [nlin, physics:physics] [Internet]. 2020 Mar 10 [cited 2020 Apr 28]; Available from: http://arxiv.org/abs/2003.05004

38. Sultana A, Awais S, Mehmood F. Knowledge about MERS (Middle Eastern Respiratory Syndrome) among Doctors in Holy Family Hospital, Rawalpindi. 2016;11:5.

39. Nour MO, Babilghith AO, Natto HA, Al-Amin FO, Alawneh SM.

Knowledge, attitude and practices of healthcare providers towards MERS-CoV infection at Makkah hospitals, KSA. :11.

40. Bhagavathula AS, Aldhaleei WA, Rahmani J, Mahabadi A, Bandari DK. Novel Coronavirus (COVID-19) Knowledge and Perceptions: A Survey of Healthcare Workers. :15.

41. Global Economic Effects of COVID-19 https://fas.org/sgp/crs/row/R46270.pdf · PDF file.

42. Zhang H, Shaw R. Identifying Research Trends and Gaps in the Context of COVID-19. International Journal of Environmental Research and Public Health. 2020 May 12;17:3370.

43. Shimizu K. 2019-nCoV, fake news, and racism. Lancet [Internet]. 2020 [cited 2021 Jan 2];395(10225):685–6. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7133552/

44. Mheidly N, Fares J. Leveraging media and health communication strategies to overcome the COVID-19 infodemic. J Public Health Pol [Internet]. 2020 Dec 1 [cited 2021 Jan 9];41(4):410–20. Available from: https://doi.org/10.1057/s41271-020-00247-w

45. 236304229.pdf [Internet]. [cited 2021 Jan 11]. Available from: https://core.ac.uk/download/pdf/236304229.pdf

46. Coronavirus Disease (COVID-19): Situation Report - 175 (13 July 2020) - World [Internet]. ReliefWeb. [cited 2021 Jan 23]. Available from: https://reliefweb.int/report/world/coronavirus-disease-covid-19-situation-report-175-13-july-2020

47. Scarpone C, Brinkmann ST, Große T, Sonnenwald D, Fuchs M, Walker BB. A multimethod approach for county-scale geospatial analysis of emerging infectious diseases: a cross-sectional case study of COVID-19 incidence in Germany. International Journal of Health Geographics [Internet]. 2020 Aug 13 [cited 2021 Jan 22];19(1):32. Available from: https://doi.org/10.1186/s12942-020-00225-1

48. Institute RK. COVID-19 Situation Report 13.07.2020. :10.

49. Kampe EO im, Lehfeld A-S, Buda S, Buchholz U, Haas W. Surveillance of COVID-19 school outbreaks, Germany, March to August 2020. Eurosurveillance [Internet]. 2020 Sep 24 [cited 2021 Jan 22];25(38):2001645. Available from: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.38.2001645

50. Asselmann E, Borghans L, Montizaan R, Seegers P. The role of personality in the thoughts, feelings, and behaviors of students in Germany during the first weeks of the COVID-19 pandemic. PLOS ONE [Internet]. 2020 Nov 30 [cited 2021 Jan 23];15(11):e0242904. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0242904

51. Ahmed K. Patterns of Social Reactions to COVID-19 Pandemic; Reasons & Proposed Ways to Overcome. Adv J Social Sci [Internet]. 2020 Jun 24 [cited 2021 Jan 23];7(1):54–9. Available from: https://journals.aijr.in/index.php/ajss/article/view/2720