Cross-sectional Study

Knowledge, attitude and practice of medical students towards COVID19 in Sudan: A cross sectional study among 19 universities

Mohammed Alfatih, Khabab Abbasher Hussien Mohamed Ahmed, Radi Tofaha Alhusseini, Elfatih A. Hasabo, Lina Hemmeda, Walaa Elnaieem, Rua Isameldin Bakhiet Mohamed, Monzer Omer Ahmed Abdalla, Khadija ala Abdalmaqasud mumhmed, Osama Mohammed Nowar Taha, Yaman Shurki Adel Husni Yousef, Rawan Raad Hassan Alrufai, Ahmed Emadaldeen Ahmed Mohammed Alamin, Muzamil Musa Mohamed Musa, Saida abdallah mohammed taha abdallah, Mohammed Mahmood Fadelallah Eljack, Basaier Mohammed Almaldeen Kharif, Areej Imad Aldeen Mohamed Idris, Sara Mohamed Abdalla Idris, Mohammed Ahmed Abugibba Mohamed, Malaz Salah Osman Gurashi, Mohammed Alfateh omer Mohammed, Ahmed Bukhari Mohamed Ahmed, Isra Mohamed Hassan Nasr, Abdlrhman saeed mohammed saeed, Mohammed Eltahier Abdalla Omer, Ahmed ElSayed, Mohannad Abdalfdeel Almahie Shaban

a Faculty of Medicine, Alzaiem Alazhari University, Khartoum, Sudan
b Faculty of Medicine, University of Khartoum, Khartoum, Sudan
c Faculty of Medicine, University of Gezira, Wad Madani, Sudan
d Faculty of Medicine, Omdurman Islamic University, Omdurman, Sudan
e Faculty of Medicine, Elzira University, Khartoum, Sudan
f Faculty of Medicine, Sudan University of Science and Technology, Khartoum, Sudan
g Faculty of Medicine, West Kordofan University, Al-Falih, Sudan
h Faculty of Medicine, Al Neelain University, Khartoum, Sudan
i Faculty of Medicine, Alzaiem Alazhari University, Khartoum, Sudan
j Faculty of Medicine, University of Khartoum, Khartoum, Sudan
k Faculty of Medicine, Omdurman Islamic University, Omdurman, Sudan
l Faculty of Medicine, Sudan University of Science and Technology, Khartoum, Sudan
m Faculty of Medicine, West Kordofan University, Al-Falih, Sudan
n Faculty of Medicine, University of Khartoum, Khartoum, Sudan

* Corresponding author.
E-mail addresses: mohammed.22.alfatih@gmail.com (M. Alfatih), Khabab9722@gmail.com (K.A.H. Mohamed Ahmed), radi.tuffaha1995@gmail.com (R.T. Alhusseini), elfatih.ahmed.hasabo@gmail.com (E. A. Hasabo), lina.hemmeda@gmail.com (L. Hemmeda), walaabaaladaldir@gmail.com (W. Elnaieem), doc.ruabakhiet@gmail.com (R.I.B. Mohamed), Mezoma302813@gmail.com (M.O.A. Abdalla), doctor.khadija.44@gmail.com (K. Abdalmagoud mumhmed), osamanowar@gmail.com (O.M.N. Taha), dr.yaman55@gmail.com (Y.S.A. Husni Yousef), rawanaaxd@gmail.com (R.R. Hassan Alrufai), ahmed311113@gmail.com (A.E. Ahmed Mohamed Alamin), muzzamel.musa@gmail.com (M.M.M. Musa), Saltkateeb529@gmail.com (S. taha abdallah), m.mahmoud96@gmail.com (M.M. Fadelallah Eljack), basar397@gmail.com (B.M.A. Kharif), areejemad@gmail.com (A.I.A. Mohamed Idris), SM1992019@gmail.com (S.M.A. Idris), mohamedaaalmar7@hotmail.com (M.A.A. Mohamed), malazsalah43@gmail.com (M.S.O. Gurashi), wdafateh@gmail.com (M.A. omer Mohammed), ahmed.sokhri@gmail.com (A.B.M. Ahmed), isranas213@gmail.com (I.M.H. Nasr), ABODY19972014@gmail.com (A. saeed), Mohamedeltefahier100@gmail.com (M.E.A. Omer), asaelsayed@hotmail.com (A. ElSayed).

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1. Introduction

On the January 7, 2020, the Chinese Centre for Disease Control and Prevention (CCDC) isolated the causative agent from throat swab samples, and the name Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was given to this virus. The World Health Organization (WHO) then renamed it Coronavirus disease-19 (COVID-19) [1]. Coronaviruses are a large family of enveloped RNA viruses that can infect a broad range of animals; including camels, cattle, cats, and bats. In relatively rare events, vectors can transmit coronaviruses to humans, and continued circulation results in human-to-human exposure [2].

COVID-19 is the third coronavirus emerging in the human population in the past two decades; as preceded by the severe acute respiratory syndrome (SARS) outbreak in 2002 and the Middle East Respiratory Syndrome (MERS) outbreak in 2012 [3,4]. All these coronaviruses have originated in bats [2]. In January 2020, the WHO described the COVID-19 outbreak as an international public health emergency. Thereafter, in March 2020, the WHO announced the disease as a pandemic [5,6].

This pandemic has captured the attention of the world due to severe political, social, psychological, and economic influences, necessitating a strong international concern and collaborative efforts from all countries to prevent the serious spread of COVID-19 [1]. More than 8 million cases were reported in Africa until September 17, 2021, with more than 226 million cases reported worldwide. Since the first occurrence of COVID-19 in Sudan on March 13, 2020, more than 38 000 cases have been confirmed and recorded, with a sum of 2833 lives lost and 31 590 cases recovered, with studies indicating a case fatality rate of 7.7% [2,3]. The firing of case numbers compelled Sudan’s government to implement immediate health measures such as isolating infected individuals and implementing personal protective measures. People are advised to avoid overcrowding and maintain proper social distancing. Hand hygiene should also be maintained through frequent hand washing and the use of hand sanitizers. Wearing facemasks and avoiding touching one’s face with one’s hands have also been shown to effectively prevent the spread of COVID-19 [7–9].

While community perception of these measures remains a source of contention. Only a few studies have been conducted in this area, demonstrating that the potency of government interventional policies was highly reliant on people’s adherence to these control measures, which was heavily influenced by their knowledge, attitude, and practice toward COVID-19 [10].

With students returning to their institutions to resume their postponed educational schedules, the seriousness of applying preventive measures can fall back on the overall population as a single case may affect entire students and thus the rest of the community; however, despite this, only a few studies have been conducted in Sudanese medical students to assess their knowledge, attitude, and practice towards Covid-19. We intend to assess medical students’ knowledge, attitudes, and practices regarding COVID-19 in 19 Sudanese universities in this cross-sectional study.

2. Methodology

2.1. Study setting

This cross-sectional study was conducted on universities that have medical schools in Sudan. The included medical schools were chosen according to their willingness to participate. A minimum of 100 medical students from each university were randomly included in this study. Out of 24 medical schools in Sudan, only 19 medical schools met our criteria to be included in this study.

2.2. Study participants

Medical students on the selected medical schools constituted our targeted participants. These students were approached by a member of the study team from their own university. The students were asked for their consent to participate, and those who agreed were given a link to the study questionnaire on a Google form. The students were approached on the social media platforms that are widely used amongst students in Sudan (Facebook and WhatsApp). This approach was complemented by telephone calls to stress the importance of our study in some instances. Additionally, the messages on the social media platforms were repeated if the response rate slowed down. Respondents were required to sign in to fill the Google form using their Google account to ensure only one response per participant. During the period from the 7th to the April 18, 2020, all the required responses were collected.

This a cross-sectional study in is fully compliant with the STROCSS 2021 criteria [11].

2.3. Data collection method

The study instrument was an online well-structured non-shuffled questionnaire developed by the authors. The questionnaire was initially
self-tested by the authors before implementation and a pilot study was done on 40 participants. Our questionnaire was delivered through Google forms questionnaire timed for 3 min and consisted of two parts:

Part one: Demographic data, which had six variables (age, gender, academic year, university name, marital status, and nationality).

Part two: Knowledge, attitudes, and practice, which had 35 questions. Following the guidelines for clinical and community management of COVID-19 by the National Health Commission of the People’s Republic of China (24), the COVID-19 knowledge questionnaire was developed by the authors. Further questions about the attitudes and practices towards COVID-19 were added to this questionnaire. This part had 23 questions regarding knowledge of COVID-19. A correct answer was assigned 1 point and an incorrect/unknown answer was assigned 0 points. Making the knowledge score ranges from zero to 23 points, with a higher score denoting a better knowledge of COVID-19. Attitudes towards COVID-19 were measured by two questions and respondents’ practice was assessed by 10 questions.

### 2.4. Statistical analysis

Statistical analysis was performed using the using R software version 4.0.2. Data were presented as number (percentages). Chi-square test and fisher exact test were used to find the difference in knowledge attitude and practice of COVID-19 between males and females. A p-value of less than 0.05 was used to determine the level of significance.

### 3. Results

#### 3.1. Sociodemographic characteristics

About 2603 medical students from 19 universities responded to the survey (Table 1). As expected, 90.9% were between 18 and 24 years of age with 90.4% of them being between the first and fifth year of medical school, and almost equally distributed through the first to fifth academic years, while those in the sixth year being less represented; this later fact was because 12 out of the 19 medical schools had a 5-year program only. There is only equal representation for the 19 universities. More details could be found on Table 2.

#### 3.2. Knowledge

Of all the respondents 74.7% take their covid-19 information from social media, and 29.3% from medical journals. Almost 86.9% Participants responded that the most common clinical symptoms of COVID 19 were added to this questionnaire. This part developed by the authors. Further questions about the attitudes and practices towards COVID-19 were added to this questionnaire. This part had 23 questions regarding knowledge of COVID-19. A correct answer was assigned 1 point and an incorrect/unknown answer was assigned 0 points. Making the knowledge score ranges from zero to 23 points, with a higher score denoting a better knowledge of COVID-19. Attitudes towards COVID-19 were measured by two questions and respondents’ practice was assessed by 10 questions.

### Table 2

| Variables              | N     | Gender                                  | p-value | Overall, N = 2,740 |
|------------------------|-------|-----------------------------------------|---------|---------------------|
| Age, years             | 2740  | Female, N = 1,741                       | <0.001  |
| 18-20                  | 1046  | 739                                     | 307     |
|                        | (38.2%)| (42.4%)                                 | (30.7%) |
| 21-22                  | 905   | 576                                     | 329     |
|                        | (33.0%)| (33.1%)                                 | (22.9%) |
| 23-24                  | 540   | 324                                     | 216     |
|                        | (19.7%)| (18.6%)                                 | (21.6%) |
| 24-25                  | 165   | 75                                      | 90      |
|                        | (6.0%) | (4.3%)                                  | (9.0%)  |
| 26 or more             | 84    | 57                                      | 57      |
|                        | (3.1%) | (1.6%)                                  | (5.7%)  |
| University             | 2740  |                                        | <0.001  |
| Ahfad University for   | 111   | 111                                     | 0 (0.0%)|
| Women                  | (4.1%)| (6.4%)                                  |         |
| AlNeelain University of Medicine | 331 | 209                                     | 122     |
| Alzaime Alazhari       | 104   | 49                                      | 55      |
| University             | (3.8%)| (2.8%)                                  | (5.5%)  |
| Bahri University       | 45    | 31                                      | 14      |
|                       | (1.6%)| (1.8%)                                  | (1.4%)  |
| Dajani University      | 105   | 71                                      | 34      |
|                       | (3.8%)| (4.1%)                                  | (3.4%)  |
| El Razi university     | 113   | 60                                      | 53      |
|                       | (4.1%)| (3.4%)                                  | (5.3%)  |
| Ibn Sina University    | 106   | 56                                      | 50      |
|                       | (3.9%)| (3.2%)                                  | (5.0%)  |
| Igda college           | 15    | 6                                       | 9 (0.9%)|
|                       | (0.5%)| (0.3%)                                  |         |
| International university of Africa | 18 | 0.7%                                    | 14      |
|                       | (0.7%)| (4.2%)                                  | (3.4%)  |
| Karany University      | 177   | 134                                     | 43      |
|                       | (6.5%)| (7.7%)                                  | (4.3%)  |
| Khartoum University    | 206   | 135                                     | 71      |
|                       | (7.5%)| (7.8%)                                  | (7.1%)  |
| National Ribat University | 40 | 10.5                                    | 25      |
| University             | (3.8%)| (3.4%)                                  | (4.3%)  |
| National University – Medicine | 103 | 60                                      | 43      |
|                       | (3.8%)| (3.4%)                                  | (4.3%)  |
| Nile valley university | 126   | 81                                      | 45      |
|                       | (4.6%)| (4.7%)                                  | (4.5%)  |
| Omdurman Islamic  | 213   | 142                                     | 71      |
| university             | (7.8%)| (8.2%)                                  | (7.1%)  |
| Shendi University      | 106   | 70                                      | 36      |
|                       | (3.9%)| (4.0%)                                  | (3.6%)  |
| Sudan international university | 115 | 80                                      | 35      |
|                       | (4.2%)| (4.6%)                                  | (3.5%)  |
| Sudan University of Science and Technology | 103 | 73                                      | 30      |
|                       | (3.8%)| (4.2%)                                  | (3.0%)  |
| UMST                   | 27    | 16                                      | 11      |
|                       | (1.0%)| (0.9%)                                  | (1.1%)  |
| University of bakht alruda college of medicine | 110 | 56                                      | 54      |
|                       | (4.0%)| (3.2%)                                  | (5.4%)  |
| University of Gezira   | 109   | 68                                      | 41      |
|                       | (4.0%)| (3.5%)                                  | (4.1%)  |
| University of Kassala  | 16    | 6                                       | 10      |
|                       | (0.6%)| (0.3%)                                  | (1.0%)  |
| University of medical science and technology | 95 | 66                                      | 29      |
|                       | (3.5%)| (3.8%)                                  | (2.9%)  |
| University of science and technology | 108 | 67                                      | 41      |
|                       | (3.9%)| (3.8%)                                  | (4.1%)  |
| West Kordouan University | 138 | 65                                      | 73      |
| University             | (5.0%)| (3.7%)                                  | (7.3%)  |
| Level                  | 2740  |                                        |         |
| Level 1                | 415   | 257                                     | 158     |
|                       | (15.1%)| (14.8%)                                 | (15.8%) |
| Level 2                | 525   | 365                                     | 160     |
|                       | (19.2%)| (21.0%)                                 | (16.0%) |
| Level 3                | 513   | 338                                     | 175     |
|                       | (18.7%)| (19.4%)                                 | (17.5%) |
| Level 4                | 543   | 327                                     | 216     |
|                       | (19.8%)| (18.8%)                                 | (21.6%) |
| Level 5                | 104874|                                        |         |

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is dry cough, and 87.2% said it’s fever, and about 27.7% indicated dry cough, fatigue and fever as the main combination of clinical symptoms for COVID-19. Also, Respiratory droplets had been identified as the main route of spread of COVID-19 by 94.1% and it was highly associated with the academic year of the medical students with a P value of (<.6), and 86.3% identified that asymptomatic persons cannot spread the virus. 97.2% said that people who contacted someone infected with the COVID-19 virus should be immediately isolated for an observation period of 14 days. (50.9%) have confidence that Sudan can win the battle against the COVID-19. More details about medical students’ knowledge could be obtained from Table 3.

### 3.3. Practice

A total of 72.2% do not go to crowded places most of them were females 78.2%. Females were also more likely to wear masks when leaving home (58.6%) with a P value = <-0.001 (significant). Regarding the use of hand sanitizer, (38.1%) said that they always use hand sanitizer after touching foreign surfaces outside their house and 9.3% answered never. Near 93.1% said that they wash their hands with soap first thing when they get back home with females (95.2%) being slightly better. Only 6.5% never used tissue after sneezing, with females being significantly better at using tissues (P value < .001). About 43.1% of females do not shake hands during this COVID-19 pandemic and when asked about frequency of shaking hands it was less among females with most of them answering sometime 70.31% which was significantly different from males with a p-value < 0.001). In addition, only 27.5% of medical students said that they still hug people. Refer to (Table 4) to explore more.

### 3.4. Overall results

We used a rating score to demonstrate the knowledge and practice of knowledge and awareness of medical students about COVID-19. Table 3 Knowledge and awareness of medical students about COVID-19.

### Table 3 Knowledge and awareness of medical students about COVID-19.

| Variables | N | Gender | Overall, N = 2,740<sup>a</sup> | Gender, N = 1,741<sup>b</sup> | p-value<sup>b</sup> |
|-----------|---|--------|-------------------------------|-----------------------------|-----------------|
| The main clinical symptoms of COVID-19 are? (can choose many answer) | 2740 | | | | |
| Dry cough | 2382 | 1495 | 887 | 0.029 |
| Fever | 2390 | 1514 | 876 | 0.6 |
| Fatigue | 1303 | 797 | 506 | 0.014 |
| Myalgia | 628 | 385 | 243 | 0.2 |
| I don’t know | 45 | 33 | 12 | 0.2 |
| What symptoms are uncommon in COVID-19 patients? (can choose many answer) | 2740 | | | | |
| Rummy nose | 1310 | 841 | 469 | 0.5 |
| Sputum | 1405 | 893 | 512 | >0.9 |
| Sneeze | 802 | 515 | 287 | 0.6 |
| I don’t know | 732 | 443 | 289 | 0.047 |
| First initial symptom of COVID19? | 2740 | | | | |
| Headache | 1323 | 865 | 458 | 0.3 |
| I don’t know | 520 | 325 | 195 | 0.4 |
| Loss of smell sensation | 277 | 180 | 97 | 0.2 |
| I don’t know | 175 | 104 | 71 | 0.2 |
| Sneeze | 374 | 225 | 149 | 0.2 |
| I don’t know | 71 | 42 | 29 | 0.2 |
| Which COVID-19 cases are most likely to develop to severe cases? (can choose many answer) | 2740 | | | | |
| Elderly | 2290 | 1454 | 836 | >0.9 |
| Young | 169 | 112 | 57 | 0.4 |
| Chronic disease patients | 2316 | 1475 | 841 | 0.7 |
| Females | 48 | 21 | 27 | 0.004 |
| Obese | 281 | 161 | 120 | 0.022 |
| I don’t know | 50 | 32 | 18 | >0.9 |
| Persons with COVID-19 cannot infect the virus to others when they don’t have a fever | 2740 | | | | |
| FALSE | 2364 | 1499 | 865 | |
| I don’t know | 273 | 177 | 96 | |
| TRUE | 103 | 65 | 38 | 0.9 |

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### Table 3 (continued)

| Variables                                      | N  | Overall, Male, N = 2,740 | Gender, Female, N = 1,741 | p-value<sup>a</sup> |
|-----------------------------------------------|----|--------------------------|---------------------------|-------------------|
| Eating or contacting wild animals would result in the infection by the COVID-19 virus? | FALSE | 793 | 495 | 298 | (29.8%) | (28.4%) | (29.8%) | 0.5 |
|                                             | I don’t know | 564 | 370 | 194 | (20.6%) | (21.3%) | (19.4%) |         |
|                                             | TRUE | 1383 | 876 | 507 | (50.5%) | (50.3%) | (50.8%) |         |
| When doing normal hospital work wearing general medical masks to prevents infection by the COVID-19 virus? | FALSE | 611 | 275 | 236 | (22.3%) | (21.5%) | (23.6%) |         |
|                                             | I don’t know | 147 | 87 | 60 | (5.4%) | (5.0%) | (6.0%) |         |
|                                             | TRUE | 1982 | 1279 | 703 | (72.3%) | (73.5%) | (70.4%) |         |
| COVID-19 virus spreads via respiratory droplets of infected individuals? | FALSE | 69 | 50 | 19 | (2.5%) | (2.9%) | (1.9%) |         |
|                                             | I don’t know | 94 | 55 | 39 | (3.4%) | (3.2%) | (3.9%) |         |
|                                             | TRUE | 2577 | 1636 | 941 | (94.1%) | (94.0%) | (94.2%) |         |
| Wear general medical masks to prevent the infection by the COVID-19 virus | FALSE | 8 | 5 | 3 | (0.3%) | (0.3%) | (0.3%) | 0.57 |
|                                             | I don’t know | 1083 | 676 | 407 | (39.5%) | (38.8%) | (40.8%) |         |
|                                             | TRUE | 1648 | 1060 | 588 | (60.2%) | (60.9%) | (59.9%) |         |
| It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus? | FALSE | 2346 | 1511 | 835 | (85.6%) | (86.8%) | (83.6%) | 0.15 |
|                                             | I don’t know | 104 | 58 | 46 | (3.8%) | (3.3%) | (4.6%) |         |
|                                             | TRUE | 290 | 172 | 118 | (10.6%) | (9.9%) | (11.8%) |         |
| To prevent the infection by COVID-19, individuals should avoid going to crowded places such as bus stations and avoid taking busy public transportation? | FALSE | 75 | 40 | 35 | (2.7%) | (2.3%) | (3.5%) |         |
|                                             | I don’t know | 63 | 38 | 25 | (2.3%) | (2.2%) | (2.5%) |         |
|                                             | TRUE | 2602 | 1663 | 939 | (95.0%) | (95.5%) | (94.0%) |         |
| Isolation of people who are infected with the COVID-19 virus is an effective way to reduce the spread of the virus? | FALSE | 62 | 34 | 28 | (2.3%) | (2.0%) | (2.8%) |         |
|                                             | I don’t know | 86 | 50 | 36 | (3.1%) | (2.9%) | (3.6%) |         |
|                                             | TRUE | 2592 | 1657 | 935 | (94.6%) | (95.2%) | (93.6%) |         |
| People who have contact with someone infected with the COVID-19 virus should be immediately isolated in a proper place. In general, the observation period is 14 days? | FALSE | 29 | 18 | 11 | (1.1%) | (1.0%) | (1.1%) | 0.7 |
|                                             | I don’t know | 47 | 27 | 20 | (1.7%) | (1.6%) | (2.0%) |         |
|                                             | TRUE | 2664 | 1696 | 968 | (97.2%) | (97.4%) | (96.9%) |         |
| How is the new greeting for the coronavirus? | By elbow | 2191 | 1382 | 809 | (80.0%) | (79.4%) | (81.0%) | 0.2 |
|                                             | By hand | 247 | 153 | 94 | (9.0%) | (8.8%) | (9.4%) |         |
|                                             | I don’t know | 302 | 206 | 96 | (11.0%) | (11.8%) | (9.6%) |         |
| Do you think that Coronavirus can spread in hot tropical climate? | No | 454 | 305 | 149 | (16.6%) | (17.5%) | (14.9%) | 0.078 |
|                                             | Yes | 2286 | 1436 | 850 | (83.4%) | (82.5%) | (85.1%) |         |
| What is most sensitive test for Coronavirus? | Chest CT scan | 613 | 397 | 216 | (22.4%) | (22.8%) | (21.6%) | 0.003 |
|                                             | Chest MRI | 220 | 145 | 75 | (8.0%) | (8.3%) | (7.5%) |         |
|                                             | Chest X Ray | 254 | 185 | 69 | (9.3%) | (10.6%) | (6.9%) |         |
|                                             | RT-PCR (True) | 1653 | 1014 | 639 | (60.3%) | (58.2%) | (64.0%) |         |
| What is most accurate sample to test for Coronavirus? | Broncho-alveolar lavage | 739 | 432 | 307 | (27.0%) | (24.8%) | (30.7%) | 0.005 |
|                                             | CBC | 256 | 159 | 97 | (9.3%) | (9.1%) | (9.7%) |         |
|                                             | Nasal swap (True) | 1485 | 977 | 508 | (54.2%) | (56.1%) | (50.9%) |         |
|                                             | Sputum sample | 260 | 173 | 87 | (9.5%) | (9.9%) | (8.7%) |         |
|                                             | Do you think that Coronavirus (COVID-19) can spread by Air? (Yes) | 1482 | 952 | 530 | (54.1%) | (54.7%) | (53.1%) | 0.2 |

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Among medical students in Sudan, was an overall good knowledge of the wave of the pandemic. This study showed that the knowledge score was assessed by the source of information that medical students get. About (80%) in the practice of the respondents [13], We attribute this good level to the source of information that medical students get. In their study among medical students in the government medical college in Uttarakhan, India, which demonstrated good knowledge (92.7%) and about (80%) in the practice of the respondents [13]. We attribute this good level to the source of information that medical students get.

In this cross-sectional study, we provided an insight of knowledge and awareness and knowledge of medical students is highly crucial. This study set out with the aim of assessing the knowledge and awareness and knowledge of medical students in Sudan concerning the novel corona virus COVID-19. In this cross-sectional study, we provided an insight of knowledge and awareness and knowledge of medical students is highly crucial. This study set out with the aim of assessing the knowledge and awareness and knowledge of medical students in Sudan concerning the novel corona virus COVID-19.

Table 3 (continued)

| Variables | N | Overall, N – 2,740 | Gender, N – 1,741 |
|-----------|---|------------------|------------------|
| Do you think that smoking can have a protective effect against Corona-virus (COVID 19)? (Yes) | 311 | 207 | 104 |
| What is the mortality rate of COVID19? | 2740 | <0.001 |
| 1-2% | 309 | 190 | 119 |
| 10-20% | 458 | 349 | 109 |
| 2-3% | 808 | 488 | 320 |
| 3-5% | 721 | 417 | 304 |
| 5-10% | 444 | 297 | 147 |
| What is transmission route of Corona-virus (COVID 19)? | 2740 | 0.03 |
| through the respiratory droplets (True) | 2300 | 1449 | 851 |
| through contact by skin | 273 | 183 | 90 |
| through the body fluids | 134 | 94 | 40 |
| through the infected wounds | 33 | 15 | 18 |
| Do you agree that COVID 19 will finally be successfully controlled? | 2740 | 0.6 |
| Agree | 1885 | 1210 | 675 |
| Disagree | 389 | 241 | 148 |
| I don’t know | 466 | 290 | 176 |

which was from (100–90) excellent, (89–80) very good, (79–70) good, (69–60) faire, (59–50) borderline and below (50%) fail. This study has found that medical students in Sudan demonstrated very good knowledge (88.9%) and good practice (78.6%) toward Covid-19.

Table 4

| Variables | N | Overall, N – 2,740 | Gender, N – 1,741 |
|-----------|---|------------------|------------------|
| Do you have confidence that Sudan can win the battle against the Corona-virus (COVID 19)? (Yes) | 2740 | 1389 | 903 | 486 |
| Do you use hand sanitizer? | 2740 | 1884 | 1210 | 674 |
| Do you still shake hands with people after Corona-virus pandemic? (Yes) | 2740 | 1627 | 991 |
| Do you use hand sanitizer after touching foreign surfaces outside your house? (Yes) | 2740 | 2122 | 1415 |
| Do you wash your hands with soap first thing when you get back home? (Yes) | 2740 | 2552 | 1657 |
| Do you use tissue paper when you sneeze or cough? | 2740 | 1164 | 832 |

4. Discussion

With the emergence of COVID-19 from the city of Wuhan, China in 2019 [1,2] and its rapid spread around the globe with more than 23 000 cases in Sudan, more than 2.5 million cases in Africa and more than 80 million cases around the globe until the end of December 2020 [9,12], knowledge, awareness and practice (KAP) about COVID-19 among medical students is highly crucial. This study set out with the aim of assessing the knowledge and awareness and knowledge of medical students in Sudan concerning the novel corona virus COVID-19.

In this cross-sectional study, we provided an insight of knowledge and practice towards COVID-19 among medical students during the first wave of the pandemic. This study showed that the knowledge score among medical students in Sudan, was an overall good knowledge of (80.9%), in addition about (78.6%) of the participants had good practice. These findings are similar with that of Sonam Maheshwari (2019) in their study among medical students in the government medical college in Uttarakhan, India, which demonstrated good knowledge (92.7%) and about (80%) in the practice of the respondents [13]. We attribute this good level to the source of information that medical students get.

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bias. On the other hand, the study included 19 universities so reflecting Ethical declaration

4-5-20) before conducting data collection.

Ethics Committee, Federal Ministry of Health of Sudan (Ethical number: 38-586)

importance of the knowledge of newly emerging diseases and the results were very positive, further education and awareness should be good knowledge and good practice toward COVID-19. Although the form of self-administered questionnaires so there is a risk of information bias. On the other hand, the study included 19 universities so reflecting the overall knowledge of Sudanese medical students with generalizable findings and up-to-date information that improve preventive measures for COVID-19.

5. Conclusion

This study has found that medical students in Sudan demonstrated good knowledge and good practice toward COVID-19. Although the results were very positive, further education and awareness should be carried out to increase the preparedness of medical students toward such pandemics and public health modules should focus more on the importance of the knowledge of newly emerging diseases and the practices towards them.

Ethical approval

Ethical clearance was obtained from the National Health Research Ethics Committee, Federal Ministry of Health of Sudan (Ethical number: 4-5-20) before conducting data collection.

Ethical declaration

Ethical clearance was obtained from the National Health Research Ethics Committee, Federal Ministry of Health of Sudan (Ethical number: 4-5-20) before conducting data collection. At the time of data collection written consent was obtained from the study participants, each participant was asked to check a question asking about his free will to participate in the study, the obtained information was confidentially handled and processed through all the research period. All the costs of doing this study were borne by the authors who had no conflict of interest.

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Author contribution

Study design, data collection, results interpretation, and writing: Mohammed Alfateh, Khabab Abbasser Hussien Mohamed Ahmed, Elfasih A. Hasabo, Lina Hemmeda, Walaaa Elnaaim.

Study design, data analysis, ethical clearance acquisition, and writing,: Radi Tofaha Alhusseini, Rua Isameldin Bakhiet Mohamed, Monzer Omer Abdalla, Khadija aia Abdalmaqsud muhammad, Osama Mohammed Nowar Taha, Yaman Shurki Adel Husni Yousef, Rawan Raad Hassan Alrufai, AHMED EMADALDEEN AHMED, MOHAMMED ALAMIN, Muzamil Musa Mohamed Musa, Saidea abdallah mohammed taha Abdallah, MOHAMMED MAHMoud FADEL ALLAH MOHAMMED, Basaier Mohammed Alamaldeen Kharif, Areej Imad Aldeen Mohamed Idris, Sara Mohamed Abdalla Idris 13 Mohammed Ahmed Abugibba Mohamed, Malaz Salah Osman Gurashi, Mohammed Alfateh omer Mohammed, Ahmed Bukhari Mohamed Ahmed.

Study design, data collection, revising and editing the drafted manuscript: Isra Mohamed Hassan Nasr, Abdhirhman saeed mahammed saeed, Mohammed Eltahier Abd la Omer, Ahmed Elsayed, Mohammad Abdalfdeel Almahie Shaban.

Registration of research studies

Name of the registry: Not applicable.

Unique Identifying number or registration ID: Not applicable.

Hyperlink to your specific registration (must be publicly accessible and will be checked): Not applicable.

Guarantor

Lina Hemmeda.

Consent

At the time of data collection written consent was obtained from the study participants, each participant was asked to check a question asking about his free will to participate in the study, the obtained information was confidentially handled and processed through all the research period.

Provenance and peer review

Not commissioned, externally peer reviewed.

Declaration of competing interest

The authors declare that there are no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jamsu.2022.104874.

References

[1] WHO Director-General’s remarks at the media briefing on 2019-nCoV on 11 February [Internet], [cited 2022 Jan 30]. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-remarks-at-the-media-briefing-on-2019-ncov-on-11-february-2020, 2020.

[2] R. Lu, X. Zhao, J. Li, P. Niu, B. Yang, H. Wu, et al., Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding [Internet], Lancet (London, England) 395 (10224) (2020 Feb 22) [cited 2022 Jan 30], https://pubmed.ncbi.nlm.nih.gov/32007145/, 565-74. Available from.

[3] N. Lee, D. Hui, A. Wu, P. Chan, P. Cameron, G.M. Joynt, et al., A major outbreak of severe acute respiratory syndrome in Hong Kong [Internet], N. Engl. J. Med. 348 (20) (2003 May 15) [cited 2022 Jan 30], https://pubmed.ncbi.nlm.nih.gov/12682352/, 1986-94. Available from.

[4] B. Hijawi, M. Abdallat, A. Sayydeydh, S. Alqarawii, A. Haddadin, N. Jaarour, et al., Novel coronavirus infections in Jordan, April 2012: epidemiological findings from a retrospective investigation, East Mediterr Heal J – La Rev Sante la Mediterr Orien – al-Majallah al-sihyab li-shaqar al-mutawatiss 19 (Suppl 1) (2013) 512-518.

[5] WHO Director-General’s opening remarks at the media briefing on COVID-19 – 11 January [Internet], [cited 2022 Jan 30]. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-january-2021, 2021.

[6] WHO Director-General’s opening remarks at the media briefing on COVID-19 - 11 March [Internet], [cited 2022 Jan 30]. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020, 2020.

[7] M.Y.E. Yousif, M.M.F.A. Eljack, M.S. Haroun, K. Abbasher Hussien Ahmed, O. Amir, M. Alfatih, et al., Clinical characteristics and risk factors associated with severe disease progression among COVID-19 patients in wad medani isolation centers: a multicenter retrospective cross-sectional study, Health Sci Rep 5 (2) (2022 Mar 1).

[8] K. Abbasher Hussien Mohamed Ahmed, E.A. Hasabo, M.S. Haroun, M. Mah Fadelallah Eljach, E.H. Salih, F.O.O. Alatyeb, et al., Clinical characteristics, complications, and predictors of outcome of hospitalized adult Sudanese patients.
with COVID-19 and malaria coinfection in Sudan: a multicenter retrospective cross-sectional study, J. Med. Virol. 94 (8) (2022 Aug 1) 3685–3697.

[9] Q. Li, X. Guan, P. Wu, X. Wang, L. Zhou, Y. Tong, et al., Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia [Internet], N. Engl. J. Med. 382 (13) (2020 Mar 26) [cited 2022 Jan 30], https://pubmed.ncbi.nlm.nih.gov/31995857/, 1199–207. Available from.

[10] A.T. Angelo, D.S. Alemayehu, A.M. Dacho, Knowledge, attitudes, and practices toward covid-19 and associated factors among university students in Mizan Tepi University, 2020, Infect. Drug Resist. 14 (2021) 349–360.

[11] G. Mathew, R. Agha, for the STROCSS Group, Strocss 2021: strengthening the Reporting of cohort, cross-sectional and case-control studies in Surgery, Int. J. Surg. 96 (2021), 106165.

[12] National Health Commission of the People’s Republic of China, A Protocol for Community Prevention and Control of the 2019 Novel Coronavirus (2019-nCoV) Infected Pneumonia, 2020.

[13] S. Maheshwari, P.K. Gupta, R. Sinha, P. Rawat, Knowledge, attitude, and practice towards coronavirus disease 2019 (COVID-19) among medical students: a cross-sectional study, J Acute Dis 9 (3) (2020) 100–104.

[14] L.T. Phan, T.V. Nguyen, Q.C. Luong, T.V. Nguyen, H.T. Nguyen, H.Q. Le, et al., Importation and human-to-human transmission of a novel coronavirus in Vietnam [Internet], N. Engl. J. Med. 382 (9) (2020 Feb 27) [cited 2022 Jan 30], https://pubmed.ncbi.nlm.nih.gov/31991079/, 872–4. Available from.