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**The Acceptance of the COVID-19 Vaccination Among
Sixth Year Medical Students in Nile University,
Khartoum, Sudan, 2021-2022**

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الاهداء

اهدي هذا البحث الى كل طالب علم يسعى لكسب وتزيد رصيده العلمي.

الى من :

*ساندتني في صلاتها ودعائها وسهرت الليالي تنير دربي
..... "امي العزيزة"

*سعى من اجل راحتى ونجاحي وعلمي ان الدنيا كفاح
وعليك بالسعي وراء طموحي "ابي العزيز"

*الذين ظفرت بهم هدية القدار باخوة فعرفوا معنى الاخوة
.....

*الى كل من ساندني ووقف بجانبى ودعمني من بداية
المشروع الي هذخ اللحظة:
"ريم مبارك , ندى سامي سعد , محمد عمر , نجلاء ابراهيم ,
سكينه عيسى , منى محمد , اكرم عبد الرحمن "

*الى دفعتي التى ساندتني والى كل الاصدقاء وجميع اهلي
وكل من يعرفني
* الى الدكتورة و المعلمه التى كانت بجانبنا دوما
د.سعاد الطاهر , لكى كل الشكر والعرفان .

اهديهم ثمرة جهدي

ولكم كل الشكر والعرفان و التقدير

نبذة مختصرة

المقدمة :

ظهر فيروس كورونا الجديد لأول مره في ديسمبر 2019 وتطور سريعاً الى جائحه عالمي لمرض فيروس كورونا (COVID-19) بحلول مارس 2020. (1) منذ ذلك الحين ,تصاعد عدد حالات الإصابة ب COVID-19 واعتباراً من 4 اغسطس 2022 هنالك اكثر من 578 مليون حاله مؤكدة من COVID-19 بما في ذلك أكثر من 6.4 مليون حاله وفاة. قد يكون التطعيم هو الإجراء الوقائي الرئيسي ضد انتشار مرض فيروس كورونا الجديد " كوفيد19" .

هدفت هذه الدراسة الى تقييم مدى قبول اللقاح ومحدداته بين طلاب الطب في السودان .

الطريقة :

تم ارسال دراسه وصفي مقطعي تم اجرائها عن طريق تطبيق استبيان يعتمد على نموذج جوجل عبر الواتس اب من 20 يونيو الى 2 يوليو 2022.

SPSS. تم تحليل البيانات باستخدام الاصدار 26 من

تم استخدام اختبار كاي سكوير لتقييم العلاقة بين التطعيم ضد كوفيد19 والمعلومات الديموغرافية بالإضافة الى المعرفة المتصورة وعوامل الخطر والرأي .

النتيجة :

من بين 135 طالبا تم اختيار 101 باستخدام عينة عشوائية بسيطة ليتم تضمينها في دراستنا. كان اكثر من 90% من الطلاب تحت سن 26 عام وكان الإناث (55, 54.5%) اكثر بقليل من الذكور (46, 45.5%) . الغالبية العظمى من الطلاب كانوا سودانيين مع اجانب يبلغ مجموعهم اقل من سدس المشاركين .

مستوى قبول اللقاح كان (46) اقل من مستوى التردد (55). كانت الاسباب الأكثر ذكرا لقبول اللقاح هي حماية انفسهم و الآخرين من عدوى كوفيد19 .

كانت المخاوف بشأن الآثار الجانبية المحتملة للقاح والشكوك حول فعاليته من الأسباب الرئيسية التي أبلغ عنها أولئك اللذين ترددوا. ادت العوامل المهمة المرتبطة بقبول اللقاح الى زيادة المخاطر (p value= 0.034) المتصورة للإصابة بكوفيد 19

بالإضافة الى الإعتقاد بأن اللقاح هو إجراء وقائي جيد ضد انتشار (p value= .000) فيروس كورونا

لم يتم العثور على ارتباط ديموغرافي مع القبول تجاه اللقاح .

Abstract:

Background:

The novel coronavirus first emerged in December 2019 and quickly developed into a global pandemic of Coronavirus disease (COVID-19) by March 2020. [1] Since then, the number of COVID-19 cases has been escalating and as of 4th August 2022 there had been over 578 million confirmed cases of COVID-19 including over 6.4 million deaths.

vaccination could be the key protective measure against the spread of the novel Coronavirus disease (COVID-19). This study aimed to assess the level of acceptance of the COVID-19 vaccine its determinants among medical students.

Methods:

A descriptive cross-sectional study conducting by applying questionnaire based on google form was sent via WhatsApp from 20th June to 2th July 2022. Data was analyzed by using a SPSS version 26. Chi-square test was used to assess the association between acceptance of the COVID-19 vaccine and demographical information, non-demographical information, and belief that Covid-19 vaccination is a good preventative measure against the spread of Coronavirus.

Result:

Out of the 135 students, 101 was selected using simple random sampling to be included in our study. Over 90% of students were under the age of 26 with females slightly more than males. The majority of students were Sudanese (n=94, 93.1%), with foreigners totaling fifteen students (14.9%). The level of acceptance of the COVID-19 vaccine was less than hesitancy (n=46, n=55). The most cited reasons for accepting the vaccine were to protect themselves and others from COVID-19 infection (n=25, 54.4%), (n=18, 39.1%). Concerns about possible side effects of the vaccine (n=18, 40%) and doubts over its efficacy (n=13, 28.9%) were the main reasons reported by those who were hesitant. Significant factors associated with vaccine acceptance was increased perceived risk of contracting Covid 19 (p value= 0.034) as well as level of agreement towards 'Covid 19 being a good preventative measure against the spread of Coronavirus' (p value=.000). No demographic association was found with acceptance towards the vaccine.



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List of Abbreviations:

COVID 19	Coronavirus disease
COVAX AMC	COVID-19 Vaccines Global Access Advance Market Commitment
IUA	International University of Africa
HCWs	Health care workers
WHO	The World Health Organization

Chapter I: Introduction and background:

I.I. Background:

The novel coronavirus first emerged in December 2019 and quickly developed into a global pandemic of Coronavirus disease (COVID-19) by March 2020. [1] Since then, the number of COVID-19 cases has been escalating and as of 4th August 2022 there had been over 578 million confirmed cases of COVID-19 including over 6.4 million deaths. [2] In Sudan, according to the Ministry of Health, as of January 2022 there had been over 38,824 confirmed cases and over 2967 deaths. [3]

Immunization is an important strategy for controlling the COVID-19 pandemic (4). The first glimpse of hope for humanity rose in December 2020 when the World Health Organization (WHO) validated the use of the first COVID-19 vaccine for humans (5). By February 2021, seven vaccines were deployed globally, with priority being given to the most vulnerable groups, including mainly the Health Care Workers (6). Herd immunity through vaccination is the target of public health interventions against COVID-19 (7).

The successful deployment of all these different vaccines to reach the optimal coverage that provides community-wide protection was challenged globally by the vaccine hesitancy (8). The concept of vaccine hesitancy refers to the rejection of vaccination or delay in considering taking it despite the presence of vaccine (9). In Sudan, multiple challenges exist in vaccinating the Sudanese population, ranging from an inadequate cold chain system to low acceptance of COVID-19 vaccination. (10)

I.II. Statement of problem:

COVID-19 is a worldwide pandemic which has claimed millions of lives. Final year medical students are vulnerable to exposure and transmission of the virus due to contact with patients in their clinical sessions in the hospitals and there is little data on their level of acceptance of the vaccine among this group in Sudan.

I.III. Rationale/ reasons for selecting this problem:

Studies showed that vaccine hesitancy is a global issue among medical students and is one of the barriers in achieving optimum coverage. Final year medical students are expected to be working at the front line after graduation dealing with Covid-19 patients and providing counselling to promote vaccine acceptance. Their attitudes towards vaccination will play an important role in future pandemics.

I.IV. General objective:

To determine the level of acceptance of COVID-19 vaccination among current 6th year medicine students studying at Nile University in the academic year 2021-2022.

I.IV. Specific Objective:

1. To measure the level of acceptance of the COVID-19 vaccine
2. To identify the associated factors of acceptance and hesitancy of COVID-19 vaccination.
3. To identify the barriers towards acceptance of the COVID-19 vaccine.

I.V. **Study Variables:**

Dependent Variables		
Number of students who accepted the Covid-19 vaccine	Numerical	Discrete
Number of students who are vaccine hesitant	Numerical	Discrete

Independent Variables:		
Age	Numerical	Discrete
Gender	Categorical	Nominal
Nationality	Categorical	Nominal
Residence	Categorical	Nominal
Source of information on COVID-19 vaccine	Categorical	Nominal
Risk perception of Covid-19 Vaccine	Categorical	Ordinal
Chronic Diseases	Categorical	Nominal
Previous Covid-19 infection	Categorical	Nominal
Previous vaccination hesitancy	Categorical	Nominal
Perceived knowledge of Covid-19 vaccination	Categorical	Ordinal

Chapter II: Literature review

The COVID-19 vaccine is a vaccine intended to provide acquired immunity against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19). Prior to the COVID-19 pandemic, an established body of knowledge existed about the structure and function of coronaviruses causing diseases like severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). This accelerated the development of various vaccine platforms during the early 2020. In 2020, the first COVID-19 vaccines were developed and made available to the public through emergency use authorization. By July 2021, at least nine different technology platforms were under research and development to create an effective vaccine against COVID-19, these include nucleic acid technologies (nucleoside-modified messenger RNA and DNA), non-replicating viral vectors, peptides, recombinant proteins, live attenuated viruses, and inactivated viruses. Messenger RNA vaccines include Pfizer-BioNTech and Moderna Vaccines. Viral vector vaccines include Oxford-AstraZeneca, Sputnik V, and Janssen COVID 19 vaccine. Inactivated vaccines include the Chinese CoronaVac. As of August 2022, forty vaccines are authorized by at least one national regulatory authority for public use. [1]

As of 22 May 2022, almost one billion people in lower-income countries remain unvaccinated [2]. Over 12.39 billion doses have been administered globally and 67% of the world population has received at least one dose of a COVID-19 vaccine, however in low-income countries that figure is only 20% [2]. According to recent statistics, just 9.9% of the Sudanese general population are fully vaccinated and 4.6% partially vaccinated; totalling 15% of the population having received at least 1 dose [3]. The concept of 'vaccine hesitancy' has been considered by the World Health Organization (WHO) as "one of the top-ten threats to public health" [5].

Unfortunately, vaccine hesitancy was documented among medical students worldwide, particularly in Africa. In Europe and Asia, the rates of vaccine acceptance were moderate to high; with high levels of vaccination reported in among medical students in Romania in a study which showed 88.5% were pro-vaccination, 7.8% undecided and 3.7% were vaccine resistant [5]. A similar study conducted at one US medical school using an online survey found that of the 167 medical students who completed the survey, less than one quarter (23%) were

hesitant about receiving the COVID-19 vaccine. [6] In India, an online questionnaire filled by 1068 medical students across 22 states found that vaccine hesitancy prevalence was 10.6%. [7]

In Contrast, in the African continent the rates of acceptance were much lower. A study in Uganda revealed low levels of acceptance of the COVID-19 vaccine among medical students (37.3%), low self-perceived risks of COVID-19, and many had relied on social media that provided them with negative information [4]. A similar study performed on Algerian medical students found just 53.51% were accepting of the vaccine [8]. Vaccine hesitancy among Egyptian medical students across two universities was found to be at 46% [9]. In Ethiopia an institutional-based cross-sectional study design conducted among 420 medical and health science students found COVID-19 vaccine hesitancy was 41.2% [10].

In Romania, the main reason for vaccine rejection was the perceived speed of vaccine development (strong agreement among the vaccine hesitant). Concern over long-term adverse reaction was present in 11.5% of respondents, however, most respondents had a positive stance towards vaccination in general [5]. In India, concern regarding vaccine safety and efficacy, hurried testing of vaccines prior to launch and lack of trust in government agencies predicted COVID-19 vaccine hesitancy. While the same study found that better awareness regarding the COVID-19 vaccine was associated with reduced hesitancy [7].

Low to middle income countries including Sudan were challenged to strategically benefit from the vaccine to stop or at least slow the current pandemic due to difficulties in achieving the optimal coverage. Sudan joined the COVAX AMC initiative in December 2020 and received 828,000 doses of the AstraZeneca vaccine through the initiative support. The national committee for COVID-19 deployment and vaccination plan prioritized the HCWs and most vulnerable groups (over 60 years and with co-morbidities) for the first phase of the vaccination to maintain the health service. Despite these efforts to make vaccines available for this key target group, a study performed from March-April 2021 among 576 HCWs showed only 57% were willing to get vaccinated. The study showed that acceptability was significantly reduced with lack of confidence in the vaccine producers, concern about the effect of vaccine storing conditions on its safety and efficacy,

potential corruption related to vaccine distribution. For those HCWs who were accepting of the COVID-19 vaccine, the main cue to accepting was to protect their families (OR=85.09, 95% CI). [11]

Another study performed in Sudan in 2021 assessed Covid 19 vaccine acceptance, hesitancy, and associated factors among fourth- and fifth-year medical students at the International University of Africa (IUA). Results showed that the majority of the students (55.8%) accepted the vaccine. Factors associated with vaccine acceptance were history of Covid 19 infection, belief that vaccine are generally safe, confidence that the vaccine can end the pandemic and receiving any vaccine in the past 5 years. Reasons stated also included for travel purposes. The study sample was from a single medical school in Sudan, the majority of the students at IUA are foreigners. Hence, the results from this study may be difficult to project to all medical students in Sudan [12].

Medical students are regarded as an insightful population that is open-minded, educated, and medically informed. They also represent the future health professionals, who are supposed to respond quickly to public health issues [13]. It is necessary to achieve high COVID 19 vaccination acceptance rates and medical students' coverage as future health care providers" [4] and critical to understand their attitudes toward the COVID-19 vaccine, [8] as they will be entrusted with providing vaccine recommendations and counseling vaccine-hesitant patients. [14]

Chapter III: Methods & Materials:

III.I. Study design:

A descriptive, cross-sectional study targeting current 6th year medical students studying at the Nile University institution.

III.II. Study population:

Sixth Year Medical Students in Nile University.

Inclusion: All medical students, both male and female, Sudanese and non-Sudanese. Nile university, Khartoum, Sudan in 2022-3

Exclusion: NONE

III.III. Study area:

Nile University is located on the Eastern Bank of the Blue Nile, Hai El Fayhaa, Alailafoon Street, East Manshia Bridge, Khartoum North, Sudan. Nile University is situated on a 160-acre campus which includes 6 buildings that serve over 2000 students. The university was established by 'Nile Higher Education Group' in 2007 and consists of 7 faculties which have since graduated over 10,000 students. The faculty of Medicine, one of the first faculties to be established has, as of May 2022, graduated 9 batches of students.

See Map in Annex D (p. XLVIII)

III.IV Sampling Design:

III.IV.I. Sample size:

We calculated a sample from the total of medical students in 6th year Nile University, which was 135, by using EPI-info 7 software.

$$n = \frac{NZ^2 p (1-p)}{d^2 (N-1) + Z^2 P(1-p)}$$

n=sample size

Z =(1.96) is the value of normal curve corresponding to level of confidence 95%

P =(0.5)is the probability of target group having the problem or prevalence rate.

1-P= (0.5)is the probability of target group not having the problem.

D=(0.05) is the desired margin of error.

$$n = \frac{135 (1.96)^2 0.5 (1-0.5)}{(0.05)^2 (135-1) + (1.96)^2 (1-0.5)}$$

n=101

III.IV.II. Sampling technique:

With support from the admission department of Nile University, weobtained the number of students and their registration numbers. Of the 135 students, 101 was selected using simple random sampling achieved by computer generated random sampling using Microsoft Excel.

III.V Data management:

III.V.I. Data Collection Tools:

We adopted a structured questionnaire, divided into three sections; the first section dealt with demographic information including: age, sex, residence and nationality among six medical students in Nile University. The second section was concerned with attitudes of acceptance and hesitancy to COVID-19 vaccines where respondents were asked to give reasons for their answers. The third section assessed COVID-19 pandemic - related knowledge and sources of information.

Questionnaires presented as Online Google forms were sent via Whatsapp application as a link to the 6th year medical students in Nile University on 15th June 2022. 53 out of 101 responded. In order to reach the target number of our sample, 101, further data was collected through written questionnaires distributed at Nile University campus due to the cutting of the Internet during the morning period from 20th June-7th July 2022, and once the target was achieved, entered online. Thesis resulted in a longer time required for data collection Those who answered the online questionnaires were excluded from the written questionnaires. After reaching 100% response, the online questionnaire was terminated and the data was saved for analysis. The data collection period occurred from the 15th June-2th July 2022.

III.V.II. Data analysis:

We exported our completed Questionnaires to Microsoft Excel for the purpose of cleaning and organizing. The data was then exported to IBM SPSS software version 26 format for statistical analysis using Qualitative data we presented as frequencies and percentages, and Chi Square Test we used for analysis. A p-value <0.05 was considered statistically significant. Results were presented as tables and graphs as appropriate.

III.VI. Ethical Considerations

The study was supervised and approved by Nile University, Faculty of Community Medicine. Participants they were consulted on their participation in the study and willing volunteers who filled our online questionnaire were included by accepting an electronic written consent form. Volunteers who filled our hard copy were required to sign a printed written informed consent form.

Chapter IV: Result

Demographic information

Out of the 135 students, the sample size of 101 was selected using simple random sampling. All participants consented and completed our questionnaire. Most students were Sudanese (n=86, 85.1%) and under the age of 26 (n=94, 93.1%), with females slightly more than males (n=55, 54.5%), (n=46, 45.5%). Foreigners totalled fifteen students (14.9%). All participants live in Khartoum State, distributed within the three localities, Khartoum, Bahri and Omdurman, with fifty-seven students (56.4%) residing in the Khartoum locality .

Table 1 summarizes the demographic information of sixth year medical students at Nile University.

		Frequency	Percentage
Age	20-25	94	93.1%
	26-30	7	6.9%
Sex	Male	46	45.5%
	Female	55	54.5%
Nationality	Sudanese	86	85.1%
	Nigerian	12	11.9%
	Egyptian	3	3.0%
Residence	Khartoum	57	56.4%
	Bahri	33	32.7%
	Omdurman	11	10.9%
Total		101	100%

Table 1. Demographic information of sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

Indicators of Vulnerability

In concern with the number of people living in the household, most of the students (n=72, 71.3%), lived in households ranging from 0-5 members, twenty-five (24.8%) in households ranging from 6-10 members and 4 students (4%) in households with more than 10 members. Concerning the household, Forty-six (45.5%) students reported living in households with person/s over the age of 60 years and thirty-five students (34.7%) living in households which included person/s with chronic disease. Students themselves reported having chronic illness and allergies, with twenty-two students reporting chronic illnesses, and forty-two (41.6%) declaring allergies. Types of comorbidities and allergies reported are described in Figures 1 and 2.

Table 2 summarizes the indicators of vulnerability among sixth year medical students at Nile University

		Frequency	Percentage
Number of people in the household	0 - 5	72	71.3%
	6 - 10	25	24.8%
	more than 10	4	4.0%
Household includes person/s over the age of 60 years	Yes	46	45.5%
	No	55	54.5%
Household include person/s with Chronic disease	Yes	35	34.7%
	No	66	65.3%
Presence of Medical Comorbidities	Yes	22	21.8%
	No	79	78.2%
Presence of Allergies	Yes	42	41.6%
	No	59	58.4%
	Total	101	100%

Table 2. Indicators of vulnerability among sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

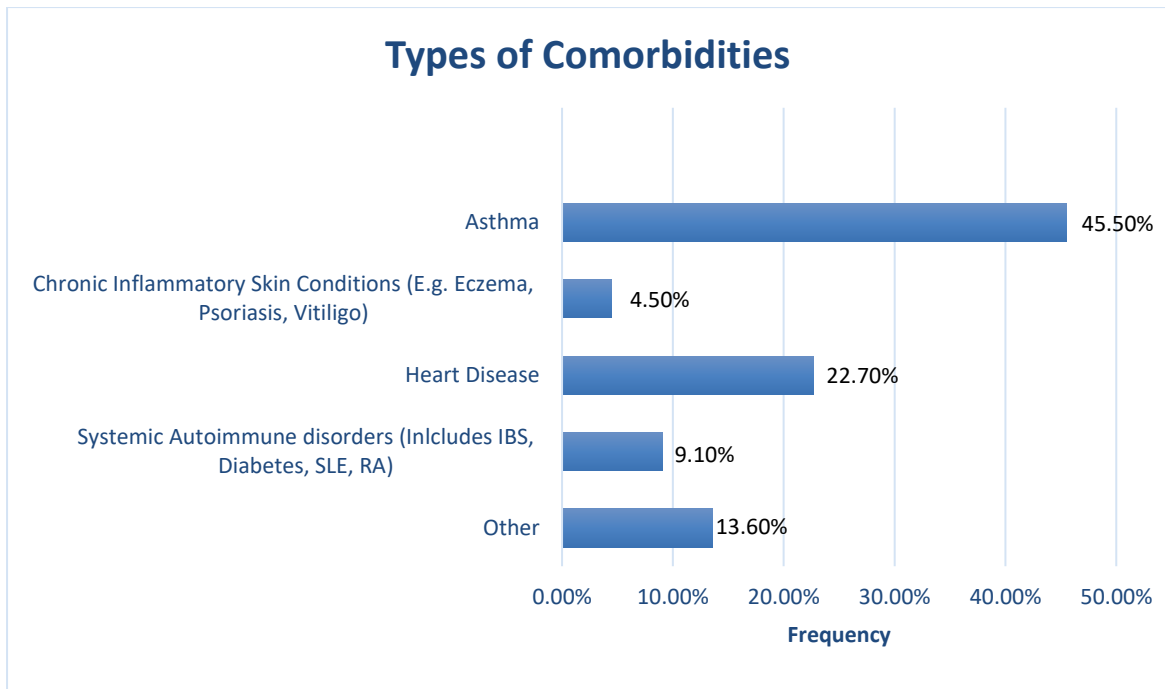


Fig 1: Types of comorbidities reported by sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

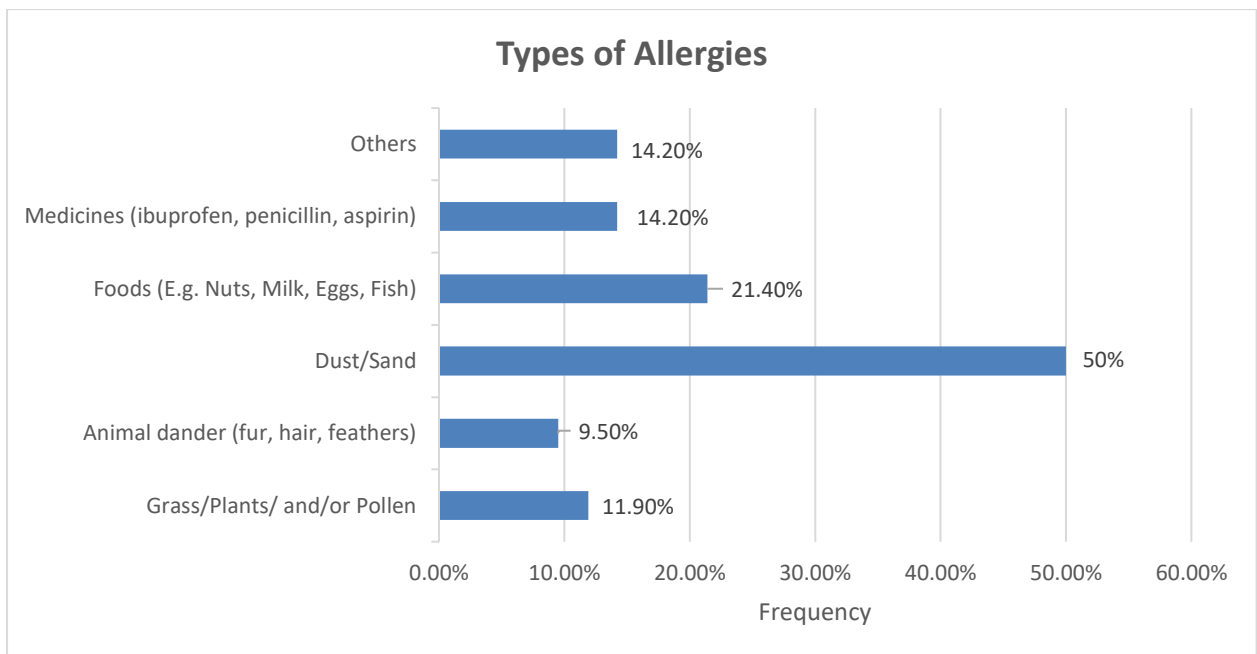


Fig 2: Types of allergies reported by sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

Non Demographic Factors Associated with Covid-19 Vaccine Acceptance and Hesitancy

Non demographic factors including perceived risk of COVID-19 infection, previous COVID-19 infection, personally knowing of someone who died of COVID-19, awareness of the availability of the vaccine in Sudan and belief that COVID-19 vaccination is a good preventative measure against the spread of the Coronavirus were assessed for association with acceptance of the Covid-19 vaccine among students. See table in Annex C (p. XLII-XLIII)

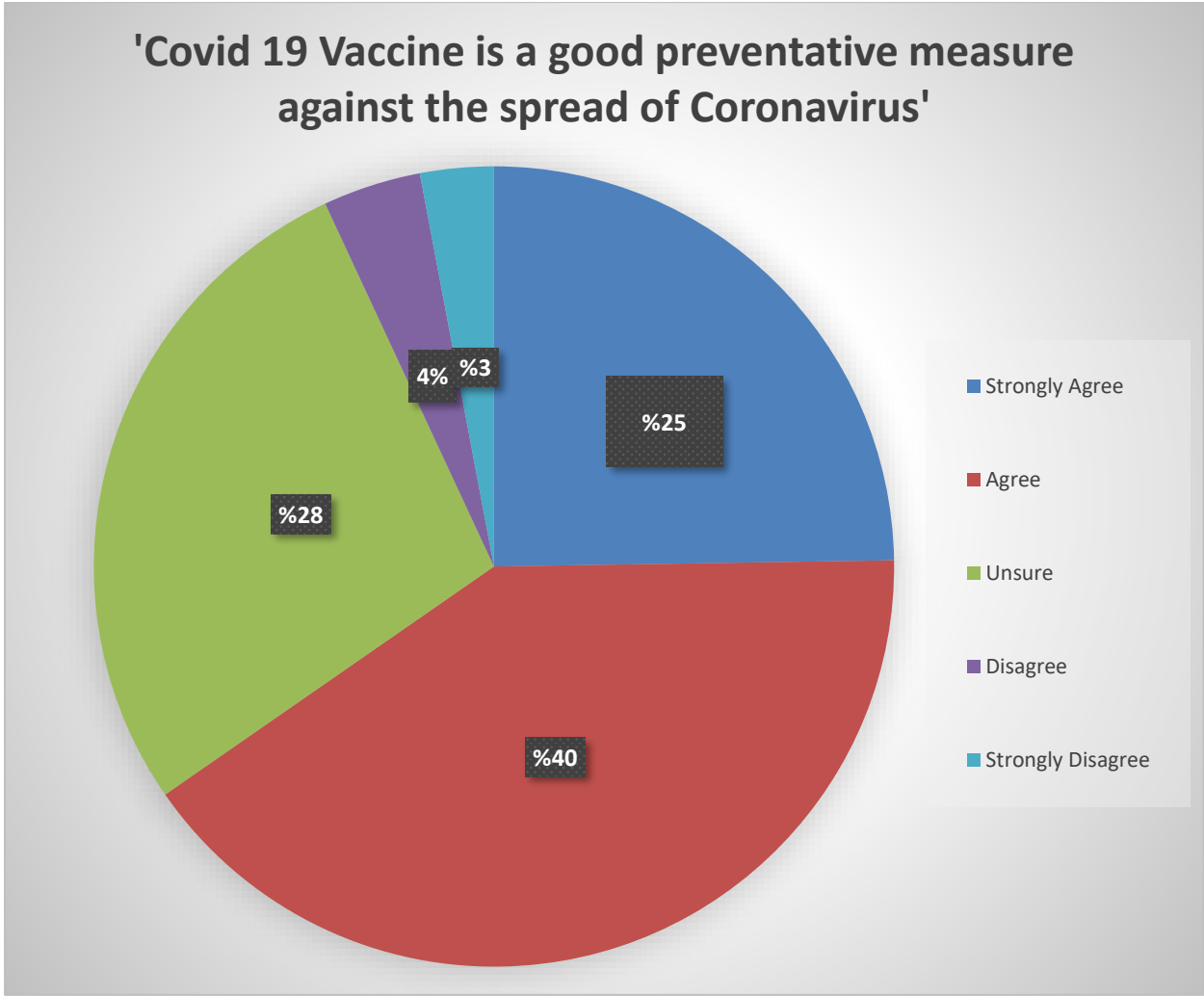


Fig 3: Level of agreement on statement 'Covid 19 Vaccine Is A Good Preventative Measure Against the Spread of Coronavirus' among sixth year medical students, Nile University, Khartoum, Sudan, 2022 (n=101)

Level of Acceptance of Covid 19 Vaccine

The level of acceptance of the Covid 19 vaccine among students was 45%, (n=46); the majority of 6th year medical students were unvaccinated (n=55, 54%).

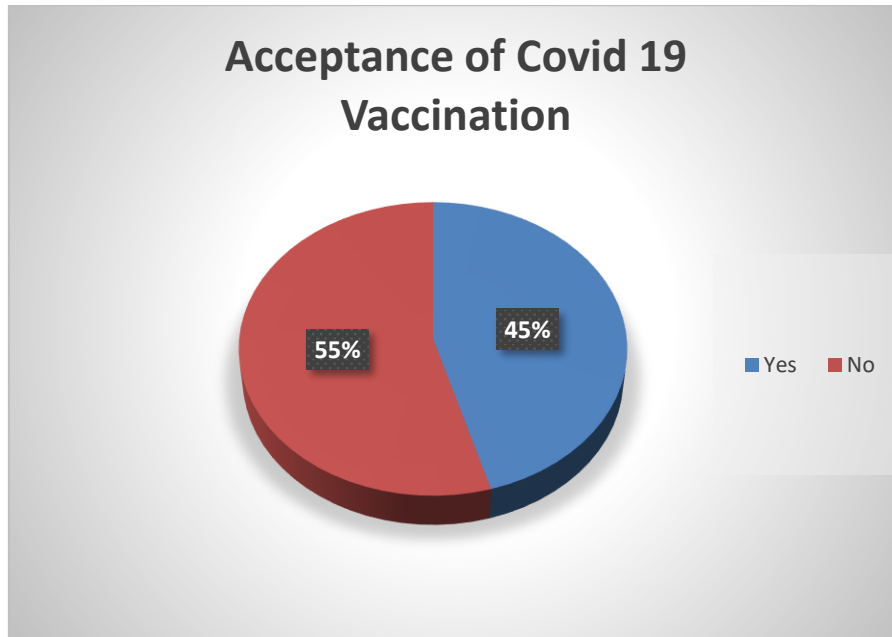


Fig 4: Acceptance of Covid-19 vaccination among sixth year medical students, Nile University, Khartoum, Sudan, 2022 (n=101)

Reasons of hesitancy and acceptance given for Covid-19 vaccination

The table below describes responses given for hesitancy and acceptance of the Covid 19 vaccine. See table in Annex C. (p. XLIV-XLV)

Previous Vaccination Hesitancy

Unvaccinated students were asked about previous vaccination hesitancy, of which the majority reported not having previous vaccination hesitancy.

Table 5 Summarizes previous vaccination hesitancy among unvaccinated sixth year medical students, Nile University

	Frequency	Percent
Yes	21	38.2%
No	34	61.8%
Total	55	100%

Table 5 Previous vaccination hesitancy among unvaccinated sixth year medical students, Nile University, Khartoum, Sudan, 2022

Perceived factors that may allow for a change in stance among hesitant students

Unvaccinated students were asked about factors that may allow for a change in stance in their position of hesitance. Forty-five out of the 55 unvaccinated students answered this question. The most common response (n=12, 21.8%) was 'A very low risk of serious side effects' could change their mind on vaccine hesitancy. The next common response, chosen equally among students (n=8, 14.5%), was 'If the protection rate was near or at 100%' and 'Nothing, I wont change my decision'.

Table 6 summaries factors reported among unvaccinated hesitant students that may allow for a change in stance among sixth year medical students at Nile University

	Frequency	Percent
a. If the protection rate was near or at 100%	8	14.5%
b. A very low risk of serious side effects	12	21.8%
c. If the vaccine was more easily accessible	6	10.9%
d. If there was only one injection required	4	7.2%
e. People around me (friends, family etc) being vaccinated	1	1.8%
f. Encouragement from my seniors in the medical field	3	5.5%
g. If I am prevented from travel due to not being vaccinated	4	7.2%
h. Nothing, I wont change my decision	8	14.5%
i. Other	1	1.8%

Table 6. Factors reported among unvaccinated hesitant students that may allow for a change in stance among sixth year medical students, Nile University. Khartoum, Sudan, 2022 (n=45)

Source of Information on Covid-19 Vaccination

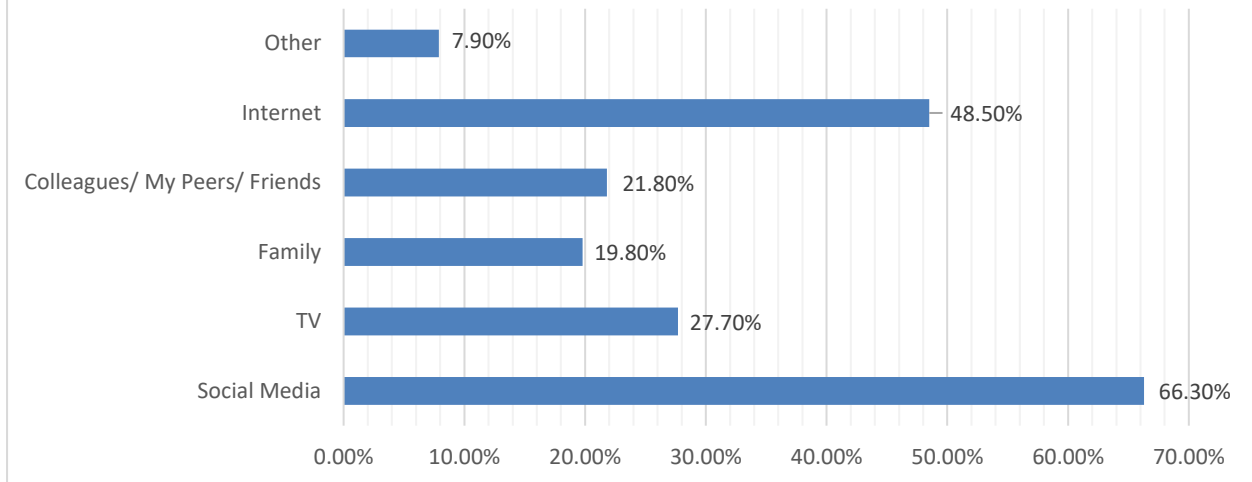


Fig 5: Source of information on COVID-19 vaccination among sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

Perceived Knowledge on Covid 19 Vaccination

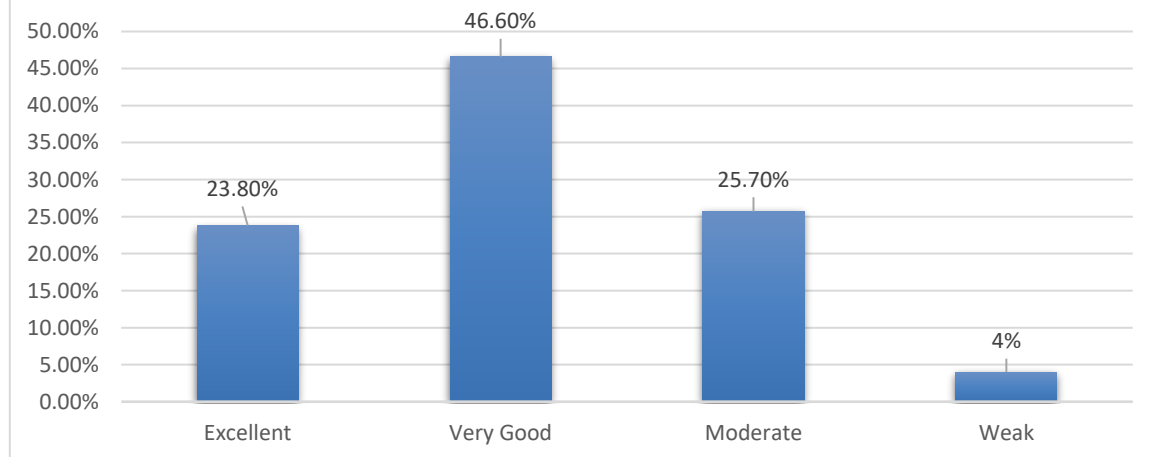


Fig 6: Perceived level of knowledge on Covid-19 Vaccination among sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

Association between the acceptance of Covid 19 vaccination with the demographic information of students

Table 7 summarizes of the association of demographic information with COVID-19 vaccination among sixth year medical students at Nile University

Demographic Information		Covid 19 Vaccination				P value
		Yes		No		
		Count	N %	Count	N %	
Age	20-25	42	44.7%	52	55.3%	.523 ^a
	26-30	4	57.1%	3	42.9%	
Sex	Male	22	47.8%	24	52.2%	.674
	Female	24	43.6%	31	56.4%	
Nationality	Sudanese	41	47.7%	45	52.3%	.589 ^a
	Nigerian	4	33.3%	8	66.7%	
	Egyptian	1	33.3%	2	66.7%	
Resident	Khartoum	22	38.6%	35	61.4%	.219
	Bahri	19	57.6%	14	42.4%	
	Omdurman	5	45.5%	6	54.5%	

Table 7. Association of demographic information with COVID-19 vaccination among sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

**Association between the factors of vulnerability with
acceptance of the Covid 19 Vaccination**

Table 8 summaries the association between factors of vulnerability and Covid 19 vaccination among sixth year medical students at Nile University. See table in Annex C (p. XLVI-XLVII)

Association between the acceptance of the Covid-19 Vaccine with the level of agreement on the statement 'Covid 19 vaccination is a good preventative measure against the spread of Coronavirus'

Table 9 summarizes the association between the acceptance of the COVID-19 vaccine and level of agreement on the statement 'Covid 19 vaccination is a good preventative measure against the spread of Coronavirus' among sixth year medical students, Nile University

"Covid 19 vaccination is a good preventative measure against the spread of Coronavirus"		Have you taken the Covid 19 Vaccine?		P value
		Yes	No	
Strongly agree	Count	19	6	.000
	N%	76%	24%	
Agree	Count	22	19	
	N%	53.7%	46.3%	
Unsure	Count	5	23	
	N%	17.9%	82.1%	
Disagree	Count	0	4	
	N%	0%	100%	
Strongly Disagree	Count	0	2	
	N%	0%	100%	

Table 9. Association between acceptance of the COVID-19 vaccine and level of agreement on the statement 'Covid 19 vaccination is a good preventative measure against the spread of Coronavirus' among sixth year medical students, Nile University, Khartoum, Sudan, 2022. (n=101)

Chapter V: Discussion, Recommendations, Conclusion

V.I Discussion

With the emergence and rapid spread of the novel coronavirus (Covid- 19) and subsequent accelerated rate of Covid 19 vaccine development and distribution, globally, low vaccine acceptance rates was reported as an issue.

The outcome of this research was to provide an insight into the level of acceptance of Covid 19 vaccine among medical students in Sudan and further knowledge on factors pertaining to vaccine acceptance and hesitancy. To the best of our knowledge, only one other similar study was conducted Sudan, involving medical students at the International university of Africa, however the majority of participants in the study were foreign students, therefore we believe our study provides a better prediction of the national issue of vaccine hesitancy in medical students and the population in general.

Our study reveals that 45.5% of the final year medical students at Nile University are vaccinated. The most reported reason for vaccination was to protect themselves and others from Covid 19 infection. Among those unwilling to vaccinate, the majority expressed concerns about adverse effects and doubts over the efficacy of the vaccine. A positive association was found with increased risk perception ($p=.034$), and belief in vaccination being a good preventative measure against the spread of the Coronavirus with acceptance of the vaccine ($p=0.000$).

The level acceptance of the Covid 19 vaccine found in our study was greater than levels reported by studies performed among Ugandan medical students, 37.3%, Ethiopian 41.2%, Egyptian 35%, as well as in Algerian medical students, 14.6%. A possible justification might be due to a difference in the study timeframe, the previous studies were performed in 2021 when Covid-19 vaccination was relatively new.

Higher acceptance rates than ours were reported in a study performed among Romanian students, 88.5%, and lower vaccine hesitancy rates than found in our study was reported among Indian medical students (10.6%), as well as in a study performed in the US among medical and dental students, in which 2 out of 10 students reporting having vaccine hesitancy. It would be expected that as western nations Romania and the US would have higher acceptance rates as their populations may be better informed about the vaccine, as well as India being itself a big producer of Covid 19 vaccines.

In Uganda, like in our findings, the most common reason for vaccine hesitancy was concern about adverse side effects and its efficiency, as well as hearing or reading negative information about Covid vaccines. In India and Romania, the perceived quick development of the vaccine was a prevalent opinion amongst the hesitant. Reasoning for acceptance was similar between all studies.

In Uganda, a positive association was found between acceptance rates and being male and single, while the Indian study, negative opinions on the vaccine, lack of trust in government and lack of awareness regarding vaccine eligibility were independently predictive of vaccine hesitancy. In Romania positive correlations were found between acceptance of the vaccine and trust in its efficacy and safety as well as being fully immunized as per national scheme. In Egypt, correlations was identified between acceptance of the vaccine and self-perception of own health status, Covid-19 infection in close social network, and the current level of study.

In the study performed in International University of Africa, Sudan, comparably to our study, a positive correlation was found between acceptance of the vaccine and concern about Covid infection as well as a favourable opinion on the Covid-19 vaccine being a good preventative measure against the Coronavirus; however, acceptance levels were found to be higher than our findings, (55.6%). It could be suggested that due to most of the participants of this study being non-Sudanese (n=155, 71.4%), the necessity of travel during the pandemic played a big role in their decision to vaccinate, supported by the large number of students who expressed 'to be able to travel' (n=71, 58,7%) as their reasoning for acceptance

Limitations

The main limitation of this study was the small sample size and the fact it was conducted in only one university so conclusions could be difficult to project on all Sudanese medical students.

V.11 Recommendations

1. This study showed that social media was the main source of information on Covid-19 vaccines among medical students. Thus, we recommend the use of online campaigns targeting social media to address misinformation about Covid-19 vaccination. Campaigns better be controlled and monitored by the Sudanese Ministry of Health to ensure correct and, accurate information is being distributed.
2. The internet and social media are a worldwide community, so we recommend greater intergovernmental collaboration to fight misinformation on Covid-19 Vaccination.
3. A proportion of medical students in this study doubt the efficacy of this vaccine and have had previous vaccine hesitancy, therefore we recommend introducing solid detailed information about vaccination in general and COVID-19 vaccination specifically into curriculum of universities to encourage better understanding and acceptance rates.

V.III. Conclusions:

In conclusion, this study has shown that vaccine acceptance among medical students is less than hesitancy which poses a clear risk to the battle against COVID-19 infection and spread. The most common reason for vaccine acceptance was concerns over COVID-19 infection, while the most common reason given for not accepting the vaccine pertained to concerns of possible serious side effects. Globally, reports of serious side effects of the vaccine are statistically low, and it could be suggested that social media, being the most common source of information on Covid-19 vaccines in this study, is the source of misinformation on this issue.

The low levels of COVID-19 acceptance found in this study are comparable to results found across the African continent. Therefore, we can conclude the issue of low acceptance rates among medical students is not just a Sudanese problem but an African problem.

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VII Annex:

VII.I. Annex (A) Questionnaire:

Section 1: Demographic information:

1) Age:

a. 20-25

b. 26-30

c. 31-35

2) Sex

a. Male

b. Female

3) Nationality

a. Sudanese

b. Nigerian

c. Egyptian

d. Somali

e. Syrian

4) Residence

a. Khartoum

b. Bahri

c. Omdurman

5) How many people share with you the same place of residence?.....

Section 2: Acceptance and hesitancy to COVID-19 vaccine:

6) Does your household include anyone over the age of 60 years?

a. Yes

b. No

7) Does your household include anyone with a Co-morbidity?

a. Yes

b. No

8) Do you have any allergies?

- a. Yes
- b. No

9) If YES in the previous question please tick an option/s if others chose Others*

- a. Grass/Plants and/or Tree Pollen
- b. Animal dander (Animal fur, hair, feathers)
- c. Dust/Sand
- d. Foods (E.g. Nuts, Milk, Eggs, Fish)
- e. Medicines (E.g. ibuprofen, penicillin, aspirin)
- f. Others

10) Do you have any medical comorbidities?

- a. Yes
- b. No

11) If YES in the previous question, please tick an option/s
If other choose Other*

- a. Asthma
- b. Chronic Inflammatory Skin Conditions (E.g. Eczema, Psoriasis, Vitiligo)
- c. Hypertension
- d. Heart disease
- e. Systemic Autoimmune disorders (Includes Inflammatory bowel disease, Diabetes TYPE1, SLE, RA)
- f. Other

12) Do you feel at risk of contracting Covid 19?

- a. Always
- b. Most of the time
- c. Sometimes
- d. Rarely
- e. Never

13) Have you previously contracted Covid-19 virus?

- a. Yes
- b. No
- c. I don't know

14) Do you know personally know someone who has died of Covid-19?

- a. Yes
- b. No

15) Are you aware of the availability of the vaccine for COVID-19 in Sudan?

- a. Yes
- b. No

16) To what extent do you agree with this statement:

"Covid 19 Vaccine Is A Good Preventative Measure Against the Spread of Coronavirus"

- a. Strongly Agree
- b. Agree
- c. Unsure
- d. Disagree
- e. Strongly Disagree

17) Have you taken the Covid 19 vaccination?

- a. Yes
- b. No
- c.

18) IF YOU ANSWERED NO in question 17, please answer the question below *

Tick next to the statement that you most agree with if none choose "Other"

- a. I'm not very concerned about being infected with COVID-19
- b. I am not at risk of severe COVID-19 infection [E.g. Hospitalisation, Requirement of Oxygen}
- c. I doubt the efficacy of the vaccine
- d. I am afraid of possible side effects of the vaccine
- e. The media (e.g. Internet, TV) has convinced me not to get the vaccine

- f. My social environment (e.g. friends, peers, colleagues, relatives) have convinced me not to get the vaccine.
- g. I think I have immunity against COVID-19
- h. Other

19) IF YOU ANSWERED NO in question 17, please answer the question below *

Have you ever been hesitant to get vaccinations before? (E.g. hepatitis B)

- a. Yes
- b. No

20) *IF YOU ANSWERED YES in question 17, please answer the question below *

Please tick next to the statement you most agree with. If none choose "Other"

- a. I don't want to be infected with COVID-19.
- b. I don't want to transmit COVID-19 to others.
- c. I trust in the efficacy of the COVID-19 vaccine.
- d. I am not worried about possible side effects of COVID 19 vaccine
- e. My social environment (e.g. relatives, friends, peers, colleagues) have convinced me to vaccinate.
- f. To be able to travel
- g. The vaccination is free of charge
- h. Other: Please State Below*

*

21) *If you are accepting of the COVID-19 vaccine but have not vaccinated what are your reasons?

- a. Have not had time to go to vaccinate
 - b. Have not been able to access vaccinations (E.g. distance, cost of transportation)
 - c. Political Unrest
 - d. My social environment (E.g. Relatives, Elders, Community) do not approve of me taking the vaccine
 - e. Other: Please State*
-

22) If you are hesitant in taking the vaccine (not willing to take the vaccine) please tick next to the statement that may change your mind about the COVID-19 Vaccine

- a. If the protection rate was near or at 100%
- b. A very low risk of serious side effects
- c. If the vaccine was more easily accessible
- d. If there was only one injection required
- e. People around me (friends, family etc) being vaccinated
- f. Encouragement from my seniors in the medical field
- g. If I am prevented from travel due to not being vaccinated
- h. Nothing, I wont change my decision
- i. Other

Section 3: COVID-19 related information:

23) Where do you get information about COVID-19 vaccination (if more than one tick more than one) If Others please state:

- a. Social media
- b. TV
- c. Family
- d. My Peers/ Friends/ Colleagues
- e. Internet
- f. Other

24) How would you rate your knowledge about Covid-19?

- a. Excellent
- b. Very Good
- c. Moderate
- d. Weak

VII.II **Annex (B) Informed Consent Form:**

Date:

Researcher:

Sponser: Nile University

Purpose of research: To evaluate the acceptance of Covid-19 vaccine among 6th year medical students in Nile University 2021- 2022

Your participation in the research is completely voluntary, and you have the right to reject answering the questionnaire.

All the information you supply will be held in confidence, without the need of providing your name, and the information you provide will be terminated after the research.

If you have questions regarding your role in the research, feel free to contact us through WhatsApp at

Signature

موجهات إقرار موافقة الشخص الخاضع للبحث أو من ينوب عنه

التاريخ:

الباحث:

برعاية: جامعة النيل

الغرض من البحث: لتقييم قبول لقاح كورونا فيروس بين طلاب السنة السادسة بجامعة النيل في 2021-2022.

مشاركتك في البحث تطوعيه تماما ولك الحق في رفض الاجابه علي الاستبيان.

سيتم الاحتفاظ بجميع المعلومات التي قدمتها في سريه ، دون الحاجة إلى تقديم اسمك ، وسيتم انهاء المعلومات التي تقدمها بعد البحث ، إذا كانت لديك أسئلة بخصوص دورك في البحث فلا تتردد في الاتصال بنا من خلال الادناه :

WhatsApp at..... :

..... : إمضاء

VII.III. Annex (C) Results:

VII.III.I. Non Demographic Factors Associated with Vaccine Acceptance and Hesitancy

Forty-nine students (48.5%) reported 'Sometimes' feeling at risk of Covid 19 infection, fifteen students (14.9%) expressed 'Rarely' feeling at risk of infection while the rest of the students, (n=37, 36.7%) selected all other options ranging from 'Always' to 'Never'.

Thirty-five students (34.7%) reported previous infection from Covid-19 and sixty students (59.4%) confirmed personally knowing of someone who had died from Coronavirus. In respect to awareness of the availability of the vaccine, the vast majority, (n=95, 94.1%) responded in the affirmative. In terms of the statement, we proposed in regard to Covid-19 vaccination being a good preventative measure against the spread of the Coronavirus, sixty-six students (65.2%) responded in the 'Strongly Agree' and 'Agree' categories, twenty-eight students (27.7%) responded 'Unsure' and a small minority, (n=7, 6.8%) disagreed with the statement.

Table 3 summaries non demographic factors associated with Covid-19 acceptance and hesitancy among sixth year medical students at Nile University

		Frequency	Percentage
Perceived risk of Covid 19 infection	Always	12	11.9%
	Most of time	11	10.9%
	Sometimes	49	48.5%
	Rarely	15	14.9%
	Never	14	13.9%
Previous Covid-19 infection	Yes	35	34.7%
	No	66	65.3%
	Yes	60	59.4%

Personally know someone who has died of Covid-19 infection	No	41	40.6%
	Yes	95	94.1%
Awareness of availability of the vaccine for COVID-19 in Sudan	Yes	95	94.1%
	No	6	5.9%
Level of agreement on Covid 19 Vaccination as a good preventative measure against the spread of Coronavirus	Strongly agree	25	24.7%
	Agree	41	40.5%
	Unsure	28	27.7%
	Disagree	4	3.9%
	Strongly disagree	3	2.9%
	Total	101	100%

Table 3 Non demographic factors associated with hesitancy and acceptance among sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

VII.III.II. Reasons of hesitancy and acceptance given for Covid-19 vaccination:

The level of acceptance towards vaccination was lower than hesitancy (n=46, n=55) respectively. Fourty-five out of the total of fifty-five unvaccinated students expressed reasons of hesitancy. The most reported reason for acceptance of the vaccine given was to protect themselves from getting infected with COVID-19 (n=25, 54.4%), followed by the protection of others (n=18, 39.1%) and to able to travel (n=11, 23.9%). Among hesitant students the most reported reason expressed was concern over possible side effects of the vaccine (n=18, 40%) followed by doubt over the vaccine's efficacy (n=13, 28.9%). Ten unvaccinated students responded to question 22, pertaining to barriers towards vaccination. The most common response was 'lack of time (n=6, 60%)' to vaccinate followed by social pressure not to vaccinate (n=2, 20%).

Table 4 summarizes reasons for acceptance and hesitancy of COVID-19 vaccine and barriers towards vaccination among sixth year medical students, Nile University

Reasons	Frequency	Percentage
Reasons of Acceptance of Covid-19 Vaccination		
a. I don't want to be infected with COVID-19	25	54.4%
b. I don't want to transmit COVID-19 to others	18	39.1%
c. I trust in the efficacy of the COVID-19 vaccine	6	13%
d. I am not worried about possible side effects of COVID 19 vaccine	1	2.1%
e. My social environment (e.g., relatives, friends, peers, colleagues) have convinced me to vaccinate	7	15.2%
f. To be able to travel	11	23.9%
Reasons of hesitancy of Covid-19 vaccination		

a. I am not very concerned about being infected with COVID-19	7	15.6%
b. I am not at risk of severe COVID-19 infection [E.g, Hospitalization, Requirement of Oxygen]	5	11.1%
c. I doubt the efficacy of the vaccine	13	28.9%
d. I am afraid of possible side effects of the vaccine	18	40%
f. My social environment (e.g. friends, peers, colleagues, relatives) have convinced me not to get the vaccine	2	4.4%
g. I think I have immunity against COVID-19	3	6.6%
h. Other	11	24.4%
Barriers towards Covid-19 vaccination		
a. Have not had time to go to vaccinate	6	60%
b. Political unrest	1	10%
c. My social environment (E.g. Relatives, Elders, Community) do not approve of me taking the vaccine	2	20%
d. Other	2	20%

Table 4 Reasons of acceptance and hesitancy of COVID-19 vaccine among sixth year medical students at Nile University and barriers towards vaccination among sixth year medical students, Khartoum, Sudan, 2022, (n=101)

VII.III.III. Association between the factors of vulnerability with acceptance of the Covid 19 Vaccination

Table 8 summaries the association between factors of vulnerability and Covid 19 vaccination among sixth year medical students at Nile University.

		Have you taken the Covid 19 vaccination?				P value
		Yes		No		
		Count	N %	Count	N %	
Does your household include anyone over the age of 60 years?	Yes	21	45.7 %	25	54.3%	.984
	No	25	45.5 %	30	54.5%	
Does your household include anyone with a Co-morbidity?	Yes	19	54.3 %	16	45.7%	.199
	No	27	40.9 %	39	59.1%	
Do you have any comorbidities?	Yes	7	31.8 %	15	68.1%	.247
	No	39	49.4 %	40	50.6%	
Do you have any allergies?	Yes	19	50.0 %	19	50.0%	.485
	No	27	42.9 %	36	57.1%	
Do you feel at risk of contracting Covid 19?	Always	9	75.0 %	3	25.0%	.034
	Most of time	8	72.7 %	3	27.3%	
	Sometimes	20	40.8 %	29	59.2%	
	Rarely	5	33.3 %	10	66.7%	

	Never	4	28.6 %	10	71.4%	
Do you know personally know someone who has died of Covid-19?	Yes	29	48.3 %	31	51.7%	.496
	No	17	41.5 %	24	58.5%	

Table 8. Association between factors of vulnerability and Covid 19 vaccination among sixth year medical students at Nile University, Khartoum, Sudan, 2022 (n=101)

VII.IV. Annex (D) Map:



Map of the location of the Nile University Campus, Khartoum, Sudan, 2022