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COVID-19 Vaccine Misinformation, Disinformation and Vaccine Hesitancy among Library and Information Science Professionals in Nigeria

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Abstract

This study investigated the extent of COVID-19 vaccine misinformation, disinformation, and their effects on COVID-19 vaccine hesitancy among library and information science (LIS) professionals in Nigeria. The study adopted a quantitative method that deployed a questionnaire-based survey research design. Two=hundred and twenty-two (222) LIS professionals in Nigeria participated in the survey. Constructed based, on the variables synthesised from various studies, the questionnaire was self-designed on Google web form and was posted on online platforms to collect data from the participants. Data were analysed using descriptive and inferential statistics (structural equation modelling) with tables and charts adopted in the presentation of the results. Findings revealed that the extent of COVID-19 vaccine misinformation and disinformation among LIS professionals in, Nigeria was at a low level. Moreover, the extent of COVID-19 vaccine hesitancy among LIS professionals in Nigeria was at a low level. Even at that low level, a striking finding was that COVID-19 vaccine misinformation had more positive effect (β = 0.357, p =0.001) on COVID-19 vaccine hesitancy than COVID-19 vaccine disinformation had (β = 0.235, p =0.027). Moreover, COVID-19 vaccine misinformation and disinformation had jointly significantly predicted COVID-19 vaccine hesitancy. Efforts should be geared towards curbing disinformation and misinformation because they pose a grave danger to public health now and in the future.

Keywords: COVID-19, Misinformation, Disinformation, Vaccine Hesitancy, Library and Information Science Professionals, Nigeria.

Introduction

Misinformation and disinformation regarding coronavirus disease 2019 (COVID-19) pose a significant threat to public health as they have the potential to exacerbate public health issues by encouraging disease spread. In order to avert this, effective communication is essential to ensure that people understand how to protect themselves and others from the virus. However, the World Health

Organisation (WHO) and its partners have been working tirelessly to filter through the noise on social media in order to give reliable COVID-19 guidance (Ennab et al., 2022). Literature has shown that the global spread of the novel coronavirus is affected by the spread of related misinformation – the so-called COVID-19 Infodemic that makes populations more vulnerable to the disease through resistance to mitigation efforts. Researchers reported that misinformation "super spreaders" are often associated with the low-credibility sources (Yang et al., 2021).

According to World Health Organisation (2021), disinformation is defined as "false information created with the intention of profiting from it or causing harm. Therefore, it becomes imperative that all stakeholders involved in the COVID-19 vaccination programme realise the negative effect of infodemic and disinformation on these efforts and actively take steps to counter them. However, vaccination is one of the most cost-effective ways of avoiding disease. High rates of successful vaccinations can help us overcome this global health challenge of COVID-19 pandemic but this is threatened by infodemic misinformation and disinformation (Farooq and Rathore, 2021). According to Ayanbode and Adetoro (2021), an infodemic is a glut of information, some accurate and some inaccurate, thus making it burdensome for people to find credible sources and reliable advice when needed.Moreover, COVID-19 vaccine disinformation is still an ongoing threat to the society (Prabagar et al., 2022).

Several studies have been carried out on the COVID-19 pandemic, COVID-19 vaccination and other associated infodemic. For instance, Hadlington et al. (2022) carried out a study on perceptions of fake news, misinformation, and disinformation amid the COVID-19 pandemic. Findings showed that fake news and misinformation spread quickly and virulently during the height of COVID-19 pandemic, potentially outpacing the spread of the virus itself across the globe. Similarly, Shahi, Dirkson and Majchrzak (2021) showed additional evidence that misinformation is often circulated with a view to distract people from authentic information. In other words, false information tends to propagate faster than semi authentic information, while brands or celebrity accounts often act as a super-spreader of misinformation, exposing more people to false information with their network. However, many of these studies were not in the context of Nigeria and the need to evident COVID-19 vaccine acceptance among the library and information science (LIS) professionals- the gatekeepers in information and knowledge management is crucial to curbing the associated misinformation and disinformation in the society. Hence, this study investigated the extent of COVID-19 misinformation, disinformation and their effects on COVID-19 vaccine hesitancy among LIS professionals in Nigeria.

Specifically the following research questions guided the study:

Research questions

1. What is the extent of COVID-19 Vaccine Misinformation among LIS professionals in Nigeria?
2. What is the extent of COVID-19 Vaccine Disinformation among LIS professionals in Nigeria?
3. What is the extent of COVID-19 Vaccine hesitancy among LIS professionals in Nigeria?
4. Are there relationships among COVID-19 Vaccine Misinformation, COVID-19 Vaccine Disinformation and COVID-19 Vaccine hesitancy?
5. When did you take the COVID-19 vaccine?

Conceptualisation and Hypotheses

Research Model

Figure 1 was developed by the authors to illustrate the assumed nexus among the three variables in this current study. In Figure 1, COVID-19 Vaccine hesitancy is a dependent variable, while COVID-19 Vaccine Misinformation and COVID-19 Vaccine Disinformation are independent variables. While COVID-19 Vaccine Misinformation and COVID-19 Vaccine Disinformation are expected to be significantly related, both are also assumed to significantly predict COVID-19 Vaccine hesitancy.

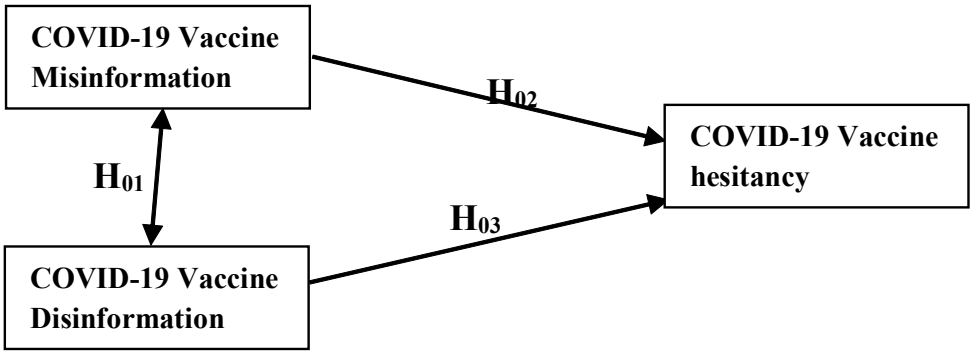

Figure 1. Hypothesised Model of COVID-19 Vaccine Misinformation, COVID-19 Vaccine Disinformation and COVID-19 Vaccine hesitancy

COVID-19 Vaccine Misinformation and Disinformation

COVID-19 vaccine misinformation is "false information about COVID-19 vaccine created with the intention of selfish gain or causing harm (WHO, 2021). Several studies have been conducted on the spread of COVID-19 vaccine misinformation and disinformation and their effects on vaccination intent. The study done by Loomba et al. (2021) on measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA, in order to inform successful vaccination campaigns, to quantify how exposure to online misinformation around COVID-19 vaccines affects intent to vaccinate to protect oneself or others. The findings revealed that in both countries recent misinformation induced a decline in vaccination intent.

A retrospective cohort study done by Lurie et al. (2022) reviewed that 41 718 (3.2% of all COVID-19 vaccine articles) contained at least one of the vaccine misinformation themes based on the Boolean string developed for the study. The study concluded that COVID-19 vaccine misinformation in traditional news media is uncommon but has the capacity to reach large numbers of readers and affect the vaccine conversation. However, recent increases in fact-checking may counteract some of the misinformation currently circulating. Elsewhere, similar finding has been reported, a retrospective observational infodemic study done by Calac et al. (2022) on the spread of COVID-19 Vaccine misinformation in the Ninth Inning established that a total of 436 tweets were initially sampled from the Twitter Search Application Programming Interface. Misinformation was the most prominent content type (n=244, 56%) detected, followed by public reaction (n=122, 28%) and media reporting (n=69, 16%).

Recent study by Skafle (2022) examined the misinformation about COVID-19 vaccines on social media: rapid review. The search yielded 757 records, with 45 articles selected for this review. They identified three main themes of misinformation: medical misinformation, vaccine development, and conspiracies. A vast majority of studies were from industrialised western countries. Additionally, a recent study has supported the implementation of integrated preventive procedures; internationalisation of infodemic management and related information technologies to prevent, disrupt, and detect misinformation and disinformation efficiently (Gradoñ et al., 2021).

Farooq and Rathore (2021) expressed that COVID-19 related infodemic and disinformation is a threat to the successful COVID-19 vaccination campaign. Hence, Gisondi et al. (2022) recommended that the social media companies should redesign social media algorithms to reduce the spread of COVID-19 misinformation, identify and remove harmful bots from platforms, censor sources of COVID-19 misinformation and disinformation. The review of previous studies may indicate a possible relationship between COVID-19 vaccine misinformation and disinformation. Notwithstanding, it was proposed that:

H_{01}: There is no significant relationship between COVID-19 Vaccine Misinformation and COVID-19 Vaccine Disinformation

COVID-19 Vaccine Hesitancy

According to the WHO (2019), vaccine hesitancy is "the delay in acceptance, reluctance, or refusal of vaccination despite the availability of vaccination services." Vaccination is a key global strategy to mitigate the clinical impact of the COVID-19 virus. As part of local efforts to manage the outbreak, the government of Ghana announced its intention to vaccinate its population starting with essential and high-risk workers including radiographers. However, there were reports of hesitance to receiving the vaccine among the radiography workforce. This study was undertaken prior to the intended vaccination exercise to assess the willingness and concerns of radiographers to undergo the COVID-19 vaccination. In this study, there were 108 responses (response rate of 46.3%). The majority (n = 64, 59.3%) were willing to have the vaccine, however, some (n = 44, 40.7%) were not. The main reason behind their willingness to have the vaccine was its ability to reduce the spread of infections and lower mortality (n = 35, 54.7%). However, doubts about the vaccine's efficacy and side effects (n = 26, 56.8%), conspiracy theory concerns about its effects on the Ghanaian race (n = 4, 9.1%), and fertility concerns (n = 2, 4.5%) were some reasons for their hesitance to receive the vaccine. The open text commentary further revealed that the vaccine was thought of as a lifesaving medication, however, clinical safety concerns, lack of education/information and religious beliefs were affecting peoples' willingness to be vaccinated. The study further showed that a large proportion of the Ghanaian radiography workforce were willing to receive the vaccine, however, a significant number were not. The observed results call for an urgent public health educational intervention from stakeholders to promptly address the COVID-19 vaccine hesitancy (Botwe et al., 2022).

Ennab et al. (2022) reported that 'infodemic' has led to rising vaccine hesitancy which is of paramount concern with the WHO even identifying it as one of the ten main threats to global health almost two years before the approval of COVID-19 vaccines. Certainly it is no exaggeration to say that lives are at stake: trustworthy information that carries the day over rumours, misinformation and dangerous speculation is critically important to confront global and local health emergencies (Alonso-Galbán and Alemañy-Castilla, 2022). It has been observed that rumours can swiftly spread online and can lead to the disruption of vaccine campaigns. In Kenya, for example, false statements regarding COVID-19 vaccines disrupting the menstrual cycle began to circulate online in May 2021(Ennab, 2022).

Gisondi, et al. (2022) confirmed that COVID-19 is currently the third leading cause of death in the United States, and unvaccinated people continue to die in high numbers. They further stated that vaccine hesitancy and vaccine refusal are fuelled by COVID-19 misinformation and disinformation on social media platforms. In the study done by Calac (2022), it was found that the death of a high-profile ethnic minority celebrity led to the spread of misinformation on Twitter. This misinformation directly challenged the safety and effectiveness of COVID-19 vaccines at a time when ensuring vaccine coverage among minority populations was paramount.

A cross-sectional study on attitudes toward receiving COVID-19 booster dose in the Middle East and North Africa (MENA) Region by Abouzid et al. (2022) said that the main reasons to refuse the booster dose were uncertainties over their safety, belief that the booster dose is unnecessary, and side effects associated with previous COVID-19 vaccine doses. A rapid review study done by Skafle (2022) identified 19 studies in which the effect of social media misinformation on vaccine hesitancy was measured or discussed. The results established that the misinformation spread on social media had a negative effect on vaccine hesitancy and uptake. They concluded that to prevent these misconceptions from taking hold, health authorities should openly address and discuss these false claims with both cultural and religious awareness in mind.

In Nigeria, a cross-sectional study was conducted by Adedeji-Adenola, Olugbake, and Adeosun (2022). The majority of the respondents were willing to get the vaccine (856; 80.9%). Those without a prior diagnosis of COVID-19 had a lower willingness to get vaccinated. The study revealed a high level of awareness, willingness to receive the vaccine and moderate perception towards the

vaccination activities. Furthermore Lucia, Kelekar and Afonso (2021) studied COVID-19 vaccine hesitancy among medical students. Finding from the study showed that nearly all participants had positive attitudes towards vaccines and agreed they would likely be exposed to COVID-19; however, only 53% indicated they would participate in a COVID-19 vaccine trial and 23% were unwilling to take a COVID-19 vaccine immediately upon FDA approval. However, misinformation and disinformation regarding COVID-19 and vaccination against it may be contributing to vaccine hesitancy (Basch et al., 2021).

In a study carried out by Troiano and Nardi (2021) on the vaccine hesitancy in the era of COVID-19, the study confirmed that several factors influenced the acceptance or refusal (ethnicity, working status, religiosity, politics, gender, age, education, income, etc.). The most given reasons to refuse vaccine were as follows: being against vaccines in general, concerns about safety/thinking that a vaccine produced in a rush is too dangerous, considering the vaccine useless because of the harmless nature of COVID-19, general lack of trust, doubts about the efficiency of the vaccine, belief to be already immunised, doubt about the provenience of vaccine. The study concluded that the high vaccine hesitancy, also during

COVID-19 pandemic, represents an important problem, and further efforts should be done to support people and give them correct information about vaccines. It is also in partial agreement with the findings of Adedeji-Adenola, Olugbake, and Adeosun (2022), whose study reviewed that some influencing factors that significantly affects awareness: religion, occupation, education and prior diagnosis of COVID-19; for perception and willingness—occupation, and prior diagnosis of the COVID-19 were influencing factors. In the same light Soares et al. (2021) specifically carried out a study on factors associated with COVID-19 vaccine hesitancy. They used multinomial regression to identify factors associated with intention to delay or refuse to take COVID-19 vaccines. The study reviewed that COVID-19 vaccine hesitancy in Portugal was high: 56% would wait and 9% refuse. The study identified several factors were associated with both refusal and delay: being younger, loss of income during the pandemic, no intention of taking the flu vaccine, low confidence in the COVID-19 vaccine and the health service response during the pandemic, worse perception of government measures, perception of the information provided as inconsistent and contradictory, and answering the questionnaire before the release of information regarding the safety and efficacy of COVID-19 vaccines.

Sallam (2021) reported that vaccine hesitancy can be the major hindrance of the control efforts to lessen the negative consequences of COVID-19 pandemic, at least in certain countries/regions. Further reviewed that the widespread prevalence of COVID-19 vaccine hesitancy mandates collaborative efforts of governments, health policy makers, and media sources, including social media companies. It is recommended to build COVID-19 vaccination trust among the general public, via the spread of timely and clear messages through trusted channels advocating the safety and efficacy of currently available COVID-19 vaccines.

Rutten et al. (2021) affirmed that vaccine hesitancy threatens to compromise the success of COVID-19 vaccination programmes. Evidences from several studies reviewed that several factors such as misinformation and disinformation among others influenced the acceptance or refusal of COVID-19 vaccines. The literature further showed that a large proportion of the people were willing to receive the vaccine, however, a significant number were not. Nevertheless, it was proposed that:

H_{02}: COVID-19 Vaccine Misinformation does not have positive effect on COVID-19 Vaccine hesitancy.

H_{03}: COVID-19 Vaccine Disinformation does not have positive effect on COVID-19 Vaccine hesitancy.

Research Methodology

Research Design, Population, and Sampling

The study adopted a survey design approach (quantitative) in order to enable the generalisation of the result to the entire population of the study. All LIS professionals in Nigeria were purposively selected. This study targeted LIS professionals in Nigeria because many of the studies done were not in the context of Nigeria and there is a need to

establish the level of COVID-19 vaccine acceptance among the LIS professionals who are regarded as the gatekeepers in information and knowledge management. The population of study was all 7298 LIS professionals spread across libraries, tertiary institutions, schools, government offices and agencies, private organisations, and broadcast institutions. Though Krejcie and Morgan (1970) recommend a sample size of 383 for such population, 222 LIS professionals responded to the questionnaire, representing a response rate of 58%.

Data Collection Instrument and Procedure

Data were collected between July, 2022 and March, 2023. Constructed based on the variables synthesised from various studies, the questionnaire was self-designed on Google web form and was administered online. The participants were invited to complete the online survey through WhatsApp platforms of LIS professionals such as NLA groups, MLA NG group, NALISE among others. In addition, colleagues were involved in distributing the questionnaire link directly to fellow professional colleagues. The questionnaire comprised four sections as follows: Section A focused on demographic characteristics of the respondents: institution, gender, age, highest educational qualification and year of professional experience. Section B elicited data on COVID-19 Vaccine Misinformation. It contained nine items synthesised from Alonso-Galbán and Alemañy-Castilla 2022, Basch et al. 2021 and Ennab et al. 2022. Section C collected data on COVID-19 Vaccine Disinformation. It contained ten items synthesised from Alonso-Galbán and Alemañy-Castilla 2022, Basch, et al. 2021, Farooq and Rathore 2021, and Section D collected data about the COVID-19 vaccine hesitancy. It contained ten items synthesised from Botwe et al. 2022, Ennab et al. 2022, Farooq and Rathore 2021. Section E elicited data on when respondents took the COVID-19 vaccine. Except for Sections A and E, the rest sections B, and C were measured on a 5-point Likert scale: To a Very Great Extent =5, To a Great Extent =4, To a Moderate Extent =3, To Low Extent =2, To No Extent =1, while section D was measured on Very true of me =5, True of me =4, I don't know=3, Not true of me=2, Never true of me =1. Content validity of the questionnaire was done through a review by two experts in the field. To determine the reliability of the questionnaire, it was pre-tested on 10 teachers from Egba Comprehensive High School, Asero, Abeokuta.

Reliability Analysis

The overall Cronbach alpha value for the whole scale was 0.96, which was above the 0.70 recommended by Nunnally (1978). Thus, indicating that the scales were good and acceptable for use in the main study.

Ethical Consideration

In the conduct of this study, the researchers ensured that ethical issues were strictly adhered to. The study was devoid of plagiarism as sources of materials were duly acknowledged and cited appropriately. Informed consent was sought by making sure that the consent form contained a comprehensive description of the research. Confidentiality was guaranteed as responses were anonymised and solely used for the research. Ethics relating to respect for persons and beneficence was ensured. In respect for persons, respondents were empowered to decide on whether or not to participate in the study and to withdraw their participation at any stage. With respect to beneficence, this study did not harm and posed no potential risk to the respondents.

Data Analysis

Collected data were analysed using descriptive (frequency counts, percentages, mean, and standard deviation) and inferential statistics (structural equation modelling) with tables, figures and charts used in the presentation of the results.

The Respondents

As shown in Table 1, exactly 110 (49.5%) of the respondents were males, while 112 (50.5%) were females. Most of the respondents, 77 (34.7%) were in the age group of 40-49 years, while 66 (29.7%) of them were in the age group of 50 years and above. The mean age of the respondents is 37.48 years (Std Deviation = 1.018). More than one third 82 (36.9%) of the respondents had master's degree, while just 54 (24.3%) had PhD. More than half of the respondents 135 (60.8%) had over 10 years of professional experience.

Table 1. Demographic characteristics of the respondents

		Frequency	*Percent*
Gender	Male	110	49.5
	Female	112	50.5
	Total	**222**	**100**
Age range	20-29	10	4.5
	30-39	69	31.1
	40-49	77	34.7
	50-59	48	21.6
	59 and Above	18	8.1
	Total	**222**	**100**
Highest Educational Qualification	Higher National Diploma	5	2.3
	Bachelor	77	34.7
	Masters	82	36.9
	PhD	54	24.3
	Other	4	1.8
	Total	**222**	**100.0**
Years of Professional Experience	0-5	36	16.2
	6-10	51	23.0
	11-15	46	20.7
	16-20	38	17.1
	21-25	24	10.8
	26-30	12	5.4
	31-35	7	3.2
	>35	8	3.6
	Total	**222**	**100.0**

Results

Descriptive Analysis

In this section, the results are presented in line with the research questions starting with research question one.

Research question 1: What is the extent of COVID-19 Vaccine Misinformation among LIS professionals in Nigeria?

Table 2. Extent of COVID-19 Vaccine Misinformation among LIS Professionals

COVID-19 Vaccine Misinformation	5	4	3	2	1	Mean	Std. Dev
Africans are the least affected, there is no need to rush to take the COVID-19 vaccines	25 (11.3)	31 (14.0)	59 (26.6)	59 (26.6)	48 (21.6)	2.67	1.272
There are ulterior motives behind the COVID-19 vaccination	29 (13.1)	26 (11.7)	43(19.4)	46 (20.7)	78 (35.1)	2.47	1.272
I feel the government has selfish intentions in the fight against COVID-19 with the vaccination exercise.	40 (18.0)	34 (15.3)	38 (17.1)	41 (18.5)	69 (31.1)	2.71	1.272
COVID-19 vaccines are not safe	21 (9.5)	19 (8.6)	40 (18.0)	51 (23.0)	91 (41.0)	2.23	1.272
COVID-19 vaccines are not well tested	32 (14.4)	29 (13.1)	51 (23.0)	43 (19.4)	67 (30.2)	2.62	1.272
COVID-19 was manufactured in the lab in order to sell COVID-19 vaccines	22 (9.9)	21 (9.5)	39 (17.6)	55 (24.8)	85 (38.3)	2.28	1.272
COVID-19 vaccines are dangerous. They are not like other vaccines	23 (10.4)	21 (9.5)	26 (11.7)	53 (23.9)	99 (44.6)	2.17	1.272
COVID-19 vaccines affect fertility.	12 (5.4)	6 (2.7)	24 (10.8)	32 (14.4)	148 (66.7)	1.66	1.272
COVID-19 vaccines cause still birth	10 (4.5)	8 (3.6)	15 (6.8)	37 (16.7)	152 (68.5)	1.59	1.272
Weighted mean = 2.27							

Note: Percentage in parenthesis

Key: To a Very Great Extent =**5**, To a Great Extent =**4**, To a Moderate Extent =**3**, To Low Extent =**2**, To No Extent =**1**

Cut off = 3.0

Results in Table 2 show the extent of COVID-19 vaccine misinformation among LIS professionals in Nigeria; the weighted mean was $\bar{x}$ 2.27 on a five-point scale with a threshold of $\bar{x}$=3.00. This suggests that the extent of COVID-19 vaccine misinformation among LIS professionals in Nigeria was at a low level. Nevertheless, at above low level, 112 (50.4%) of the respondents felt that the government had selfish intentions in the fight against COVID-19 with the vaccination exercise ($\bar{x}$=2.71), 115 (51.9%) indicated that Africans are the least affected, there is no need to rush to take the COVID-19 vaccines ($\bar{x}$= 2.67), and 112 (50.5%) of the respondents indicated that COVID-19 vaccines are not well tested ($\bar{x}$= 2.62). The findings suggest that probably, many of the LIS professionals had adequate information literacy skills.

Research question 2: What is the extent of COVID-19 Vaccine Disinformation among LIS professionals in Nigeria?

Table 3. Extent of COVID-19 Vaccine Disinformation among LIS Professionals

COVID-19 Vaccine Disinformation	**5**	**4**	**3**	**2**	**1**	**Mean**	**Std. Dev**
Be warned, COVID-19 vaccines are biological weapons.	15 (6.8)	17 (7.7)	27 (12.2)	41 (18.5)	122 (55.0)	1.93	1.260
COVID-19 vaccines are developed to reduce African population, don't take any of them	22 (9.9)	(8.1)	16 (7.2)	37 (16.7)	129 (58.1)	1.95	1.369
COVID-19 vaccines are meant to alter genetic makeup of people, avoid them	17 (7.7)	16 (7.2)	19 (8.6)	43 (19.4)	127 (57.2)	1.89	1.277
COVID-19 vaccines will only make the western world richer. So, it not necessary to take any of them.	20 (9.0)	25(11.3)	27 (12.2)	40 (18.0)	110 (49.5)	2.12	1.368
COVID-19 vaccines are ordinary mixture of multivitamins. Please, go natural.	11 (5.0)	19 (8.6)	28 (12.6)	41 (18.5)	123 (55.4)	1.89	1.210
Be warned, COVID-19 vaccines trigger hypertension	12 (5.4)	12 (5.4)	28 (12.6)	29 (13.1)	141 (63.5)	1.76	1.189
COVID-19 vaccines trigger heart attack. Please, avoid them	12 (5.4)	13 (5.9)	21 (9.5)	42 (18.9)	134 (60.4)	1.77	1.171
Many people died as a result of taking COVID-19 vaccine than of the disease itself.	11 (5.0)	(9.0)	20 (9.0)	43 (19.4)	128 (57.7)	1.84	1.206
One is likely to develop some severe side effects from COVID-19 vaccines. Please, take caution	33 (14.9)	28(12.6)	34 (15.3)	49 (22.1)	78 (35.1)	2.50	1.451
No enough research evidence to back the potency of the vaccines. Avoid them.	34 (15.3)	27(12.2)	40 (18.0)	58 (26.1)	63 (28.4)	2.60	1.407
Weighted mean = 2.03							

Note: Percentage in parenthesis

Key: To a Very Great Extent =**5**, To a Great Extent =**4**, To a Moderate Extent =**3**, To Low Extent =**2**, To No Extent =**1**

Cut off =3.0

Results in Table 3 show the extent of COVID-19 vaccine disinformation among LIS professionals in Nigeria; the weighted mean was $\bar{x}$ = 2.03 on a five-point scale with a threshold of $\bar{x}$=3.00. This suggests that the extent of COVID-19 vaccine disinformation among LIS professionals in Nigeria was at a low level, generally. Notwithstanding, at above low level, just 101 (45.5%) of the respondents believed that there is not enough research evidence to back the potency of the vaccines. So, they should be avoided ($\bar{x}$=2.60), 95 (42.8%) indicated that one is likely to develop some severe side effects from COVID-19 vaccines ($\bar{x}$= 2.50). The findings suggest that many of the LIS professionals were not victims of COVID-19 vaccine disinformation.

Research question 3: What is the level of COVID-19 Vaccine hesitancy among LIS professionals in

Table 4. Level of COVID-19 Vaccine hesitancy among LIS professionals in Nigeria

COVID-19 Vaccine hesitancy	5	4	3	2	1	Mean	Std. Dev
Till now I am sceptical about taking the COVID-19 vaccine	40 (18.0)	34 (15.3)	23 (10.4)	39 (17.6)	86 (38.7)	2.56	1.555
It took me time to decide on taking COVID-19 vaccine but I eventually took it	53 (23.9)	46 (20.7)	18 (8.1)	38 (17.1)	67 (30.2)	2.91	1.595
I delayed taking the vaccine because I was sceptical about its effectiveness and side effects	89 (40.1)	39 (17.6)	25 (11.3)	21 (9.5)	48 (21.6)	3.45	1.596
I am not willing to take the vaccine because of I heard it affects people with underlying health conditions	60 (27.0)	20 (9.0)	22 (9.9)	34 (15.3)	86 (38.7)	2.70	1.673
I hold back from taking the vaccine because I am not sure I will tolerate it	58 (26.1)	25 (11.3)	26 (11.7)	37 (16.7)	76 (34.2)	2.78	1.631
Some pieces of information I have about the vaccine do not inspire me to take it.	61 (27.5)	38 (17.1)	23 (10.4)	33 (14.9)	67 (30.2)	2.97	1.624
I refused to take the vaccine because I was not sure of its effectiveness and side effects.	55 (24.8)	24 (10.8)	17 (7.7)	35 (15.8)	91 (41.0)	2.63	1.664
I am not just interested in taking the vaccine	47 (21.2)	20 (9.0)	27 (12.2)	28 (12.6)	100 (45.0)	2.49	1.616
I don't need the vaccine	51 (23.0)	13 (5.9)	22 (9.9)	27 (12.2)	109 (49.1)	2.41	1.653
I will do everything to dodge taking the vaccine	44 (19.8)	11 (5.0)	26 (11.7)	29 (13.1)	112 (50.5)	2.31	1.588
Weighted Mean = 2.47							

Note: Percentage in parenthesis

Key: Very true of me =**5**, True of me =**4**, I don't know=**3**, Not true of me=**2**, Never true of me =**1**

Cut off =3.0

Nigeria?

Results in Table 4 show the extent of COVID-19 Vaccine hesitancy among LIS professionals in Nigeria; the weighted mean was $\bar{x}$ 2.47 on a five-point scale with a threshold of $\bar{x}$=3.00. This suggests that the extent of COVID-19 Vaccine hesitancy among LIS professionals in Nigeria was at a low level, generally. For example, 63.6% of the participants responded negatively to the statement 'I will do everything to dodge taking the vaccine' ($\bar{x}$=2.31). Also, 141 (61.3%) attached great importance to vaccination by responding negatively to the statement 'I don't need the vaccine' ($\bar{x}$=2.41). Notwithstanding, at above low level, more than half (n =128, 57.7%) of the respondents indicated that they delayed taking the vaccine because they were sceptical about its effectiveness and side effects ($\bar{x}$ =3.45), and less than half (n =99, 44.6%) of the respondents indicated that some pieces of information they had about the vaccine did not inspire them to take it ($\bar{x}$ = 2.97). The findings suggest that the majority of the LIS professionals were well informed to make positive and appropriate decision to take COVID-19 vaccine.

Research question 4: When did you take the

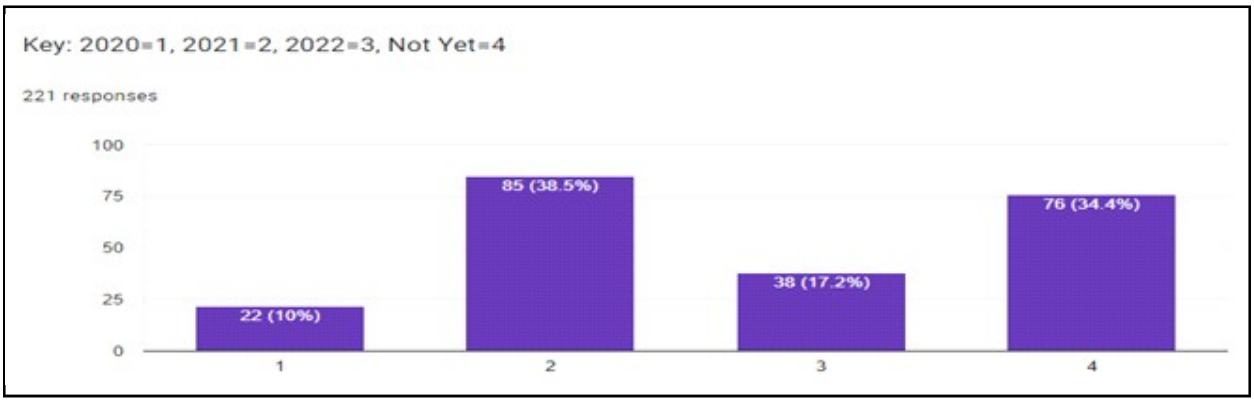

Figure 2. When Respondents took the COVID-19 vaccine

Results in Figure 2 show how many of the respondents took the vaccine and when. More than half, 145 (65.3%) of the respondents indicated that they had taken one brand of the COVID-19 vaccine or another. Of the 145 respondents, only 10% of them took the vaccine in 2020. This suggests an initial very low positive response to vaccination. Over one third 34.4% of them were yet to take the vaccine. This further corroborates that COVID-19 Vaccine hesitancy existed among LIS professionals in Nigeria though at a low level.

Inferential Analysis

In this analysis, Structural Equation modelling (SEM) was employed. The measurement model was first assessed using Confirmatory Factor Analysis (CFA) and thereafter the structural model was assessed. This is because the study deployed hypotheses testing to establish causal effects. The SEM were conducted using AMOS version 23.

Data Reduction Using Principal Component Analysis

Kaiser-Meyer-Olkin measure of sampling adequacy test accounted for 89.6%, which was higher than the 60% threshold recommended by Hair et al. (2010). Bartlett's test was significant x^2= 1945.970, df = 78, p= 0.000, indicating that the items were appropriate factors.

Loadings

Table 5 shows that seventeen items loaded on three factors (constructs). All the items loadings were >0.50 ranging from 0.71 to 0.90. Hence, all the three constructs have satisfactory convergent validity. Items of same constructs loaded highly on their constructs in comparison to their loadings on other different constructs. This confirms the discriminant validity. The extracted factors accounted for 73.8% of the total variance and their eigenvalues ranged from 1.157 to 6.589.

Table 5. Rotated Component Matrix

Codes	Items	Component		
		1	2	3
MIS7	There are ulterior motives behind the COVID-19 vaccination	**0.740**	0.122	0.293
MIS8	I feel the government has selfish intentions in the fight against COVID-19 with the vaccination exercise.	**0.741**	0.223	0.186
MIS9	COVID-19 vaccines are not safe	**0.713**	0.286	0.261
MIS10	COVID-19 vaccines are not well tested	**0.766**	0.204	0.182
MIS11	COVID-19 was manufactured in the lab in order to sell COVID-19 vaccines	**0.733**	0.087	0.328
VH25	Till now I am sceptical about taking the COVID-19 vaccine	0.176	**0.799**	0.232
VH30	Some pieces of information I have about the vaccine do not inspire me to take it.	0.277	**0.786**	0.209
VH31	I refused to take the vaccine because I was not sure of its effectiveness and side effects.	0.162	**0.901**	0.137
VH32	I am not just interested in taking the vaccine	0.152	**0.863**	0.130
DIS15	Be warned, COVID-19 vaccines are biological weapons.	0.326	0.141	**0.815**
DIS16	COVID-19 vaccines are developed to reduce African population, don't take any of them	0.343	0.243	**0.817**
DIS17	COVID-19 vaccines are meant to alter genetic makeup of people, avoid them	0.385	0.194	**0.784**
DIS22	Many people died as a result of taking COVID-19 vaccine than of the disease itself.	0.168	0.215	**0.854**

Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

Key: MIS= misinformation, DIS = disinformation, VH = vaccine hesitancy

COVID-19 vaccine?

Confirmatory Factor Analysis: Measurement Model Assessment

Figure 3 presents the result of Pooled CFA. The model consists of three First-Order Constructs, which are: (i) COVID-19 Vaccine Misinformation, (ii) COVID-19 Vaccine Disinformation, and (iii) COVID-19 Vaccine Hesitancy. The figure reveals the correlation among COVID-19 Vaccine Misinformation, COVID-19 Vaccine Disinformation, and COVID-19 Vaccine Hesitancy.

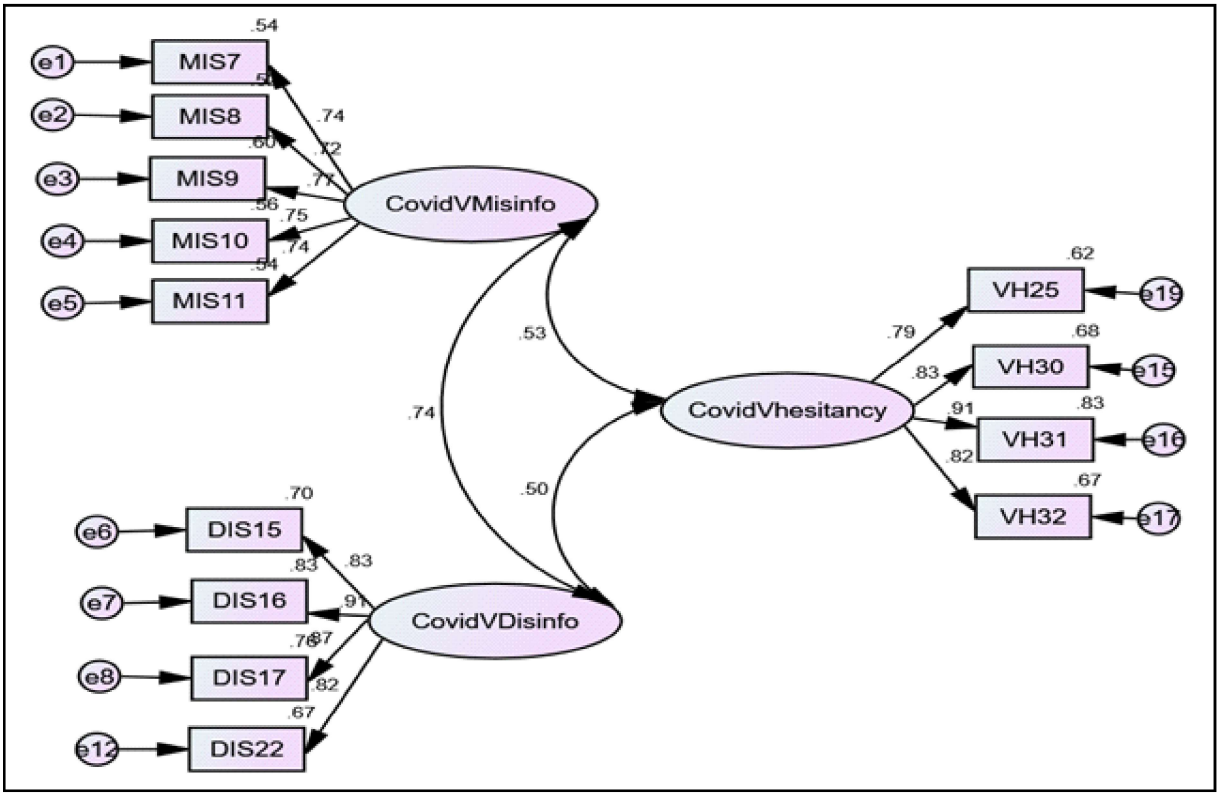

Figure 3. Pooled CFA illustrates the factor loading for all items

Model indices: *P= 0.000, x^2= 145.673, df= 62, GFI= 0.913, NFI= 0.927, CFI= 0 .956, TLI= 0.945, RMSEA= 0 .078(0.062-0.095), RMR=0 .095, SRMR= 0.047*

Figure 3 presents the result of the CFA. Based on Kline's (2005) recommendation, four goodness indices: chi-square (χ^2) with degree of freedom, mean-square residual (SRMR), standard root mean approximation (RMSEA) with 90% confidence interval, and comparative fit index (CFI) were used to assess the model fit. According to Kline (2005), RMSEA <0.10, CFI =0.90, and SRMR < 0.10 are generally considered favourable. Thus, the model fit indices: (χ^2) =145.673, df= 62, RMSEA= 0.078(0.062-0.095), CFI= 0.956, and SRMR= 0.047 show that the model is acceptable for structural modelling.

Table 6. Construct reliability and validity

Constructs	No of Items	Composite reliability (CR)	Croncbach's Alpha (CA)	Average Variance Extract (AVE)
CovidVMisinfo	5	0.857	0.820	0.546
CovidVDisinfo	4	0.890	0.895	0.669
CovidVhesitancy	4	0.904	0.850	0.703
	13			

Table 6 presents values of reliability and validity for the three constructs, which must be established before engaging the model in structural equation modelling.

(a) Construct reliability

Table 6 shows that each construct has estimates of CA and CR >0.70 as recommended by Fornell and Larcker (1981). Thus, all the constructs are adequately reliable.

(b) Convergent validity

This was assessed using Average Variance Extracted (AVE) for each construct. Table 6 shows that all the three constructs have AVE value of 0.50 and above as recommended by Fornell and Larcker (1981), Hence, the convergent validity of the constructs was acceptable.

(c) Discriminant validity

Using Fornell and Larcker's (1981) recommendation, the discriminant validity of the constructs was acceptable since the square roots of the AVEs are greater than the Inter-correlations of the constructs.

Table 7: Discriminant validity

	CovidVhesitancy	CovidVDisinfo	CovidVMisinfo
CovidVhesitancy	0.838		
CovidVDisinfo	0.498	0.818	
CovidVMisinfo	0 .530	0.736	0.739

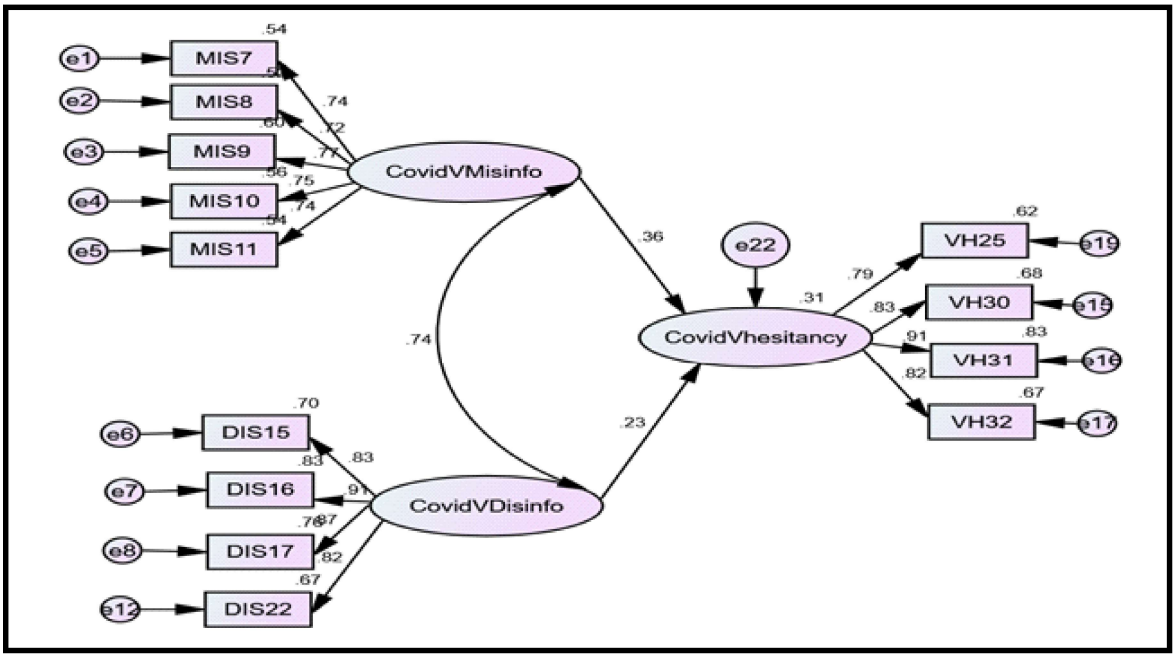

Figure 4. Structural model

Figure 4 presents the result of structural model assessment, confirming the relationships among the variables: the correlation between COVID-19 Vaccine Misinformation and COVID-19 Vaccine Disinformation, and the predictive effects of both on COVID-19 Vaccine hesitancy.

Hypothesis Testing

Table 8 presents the hypothesised paths of the structural model (as shown in Figure 4), showing the correlation and causal effects between variables. Maximum likelihood estimation was used to generate the estimates. The null hypotheses (H_0) were rejected

Table 8. Hypothesised relationships

	Hypothesised Relationships			Unstandardised Regression coefficients				Standardised Regression coefficients	Remark
				B	SE	CR	P	β	
H_{01}	CovidVMisinfo	<-->	CovidVDisinfo	0.800	0.114	6.988	0.000	0.736	Null hypothesis rejected
H_{02}	CovidVMisinfo	-->	CovidVhesitancy	0.421	0.132	3.194	0.001	0.357	Null hypothesis rejected
H_{03}	CovidVDisinfo	-->	CovidVhesitancy	0.273	0.124	2.211	0.027	0.235	Null hypothesis rejected

Note: CovidVMisinfo = COVID-19 Vaccine Misinformation, CovidVDisinfo = COVID-19 Vaccine Disinformation, CovidVhesitancy = COVID-19 Vaccine Hesitancy

Research Hypothesis 1: There is no significant relationship between COVID-19 Vaccine Misinformation and COVID-19 Vaccine Disinformation.

Table 8 shows a significant relationship between the exogenous variable (COVID-19 Vaccine Misinformation) and the exogenous variable (COVID-19 Vaccine Disinformation) among LIS professionals in Nigeria ($\beta = 0.736$, $p = 0.000$). The null hypothesis was therefore rejected. This means that COVID-19 Vaccine Misinformation had strong significant relationship with COVID-19 Disinformation among LIS professionals in Nigeria. They were found to jointly account for 30.6% of variance in COVID-19 Vaccine hesitancy among LIS professionals in Nigeria ($R^2 = 0.306$).

Research Hypothesis 2: COVID-19 Vaccine Misinformation does not have positive effect on COVID-19 Vaccine hesitancy.

Table 8 shows a significant relationship between the exogenous variable (COVID-19 Vaccine Misinformation) and the endogenous variable (COVID-19 Vaccine hesitancy) among LIS professionals in Nigeria ($\beta = 0.357$, $p = 0.001$). The null hypothesis was therefore rejected. This means that COVID-19 Vaccine Misinformation had significant positive effect on COVID-19 Vaccine hesitancy among LIS professionals in Nigeria. This suggests that the COVID-19 Vaccine Misinforma-tion possibly caused the delayed response of LIS professionals to COVID-19 Vaccination.

Research Hypothesis 3: COVID-19 Vaccine Disinformation does not have positive effect on COVID-19 Vaccine hesitancy.

Table 8 shows a significant relationship between the exogenous variable (COVID-19 Vaccine Disinformation) and the endogenous variable (COVID-19 Vaccine hesitancy) among LIS professionals in Nigeria ($\beta = 0.235$, $p = 0.027$). The null hypothesis was therefore rejected. This means that COVID-19 Vaccine Disinformation had significant positive effect on COVID-19 Vaccine hesitancy among LIS professionals in Nigeria. This suggests that the COVID-19 Vaccine Disinformation possibly weakly affected the positive response of LIS professionals to COVID-19 Vaccination.

at $p \leq 0.05$.

Discussion

Demographic characteristics of the respondents provided relevant information about the participants in this study. The mean age of the respondents was 37.48 years (Std Deviation = 1.018). More than one third 82 (36.9%) of the respondents had master's degree, while close to one fourth, 54 (24.3%) of them had PhD. More than half of the respondents 135 (60.8%) had over 10 years of professional experience.

Findings revealed that the extent of COVID-19 vaccine misinformation and disinformation among LIS professionals in Nigeria was at a low level. For example, it is clear that they were not dissuaded by COVID-19 vaccine misinformation such as: there are ulterior motives behind the COVID-19 vaccination, COVID-19 vaccines are not safe, COVID-19 was manufactured in the lab in order to sell COVID-19 vaccines, COVID-19 vaccines are dangerous; they are not like other vaccines, COVID-19 vaccines affect fertility, and COVID-19 vaccines cause still birth among others. Similarly, Loomba et al. (2021) reported the existence of COVID-19 vaccine misinformation among people in the UK and the USA.

Moreover, majority of LIS professionals in Nigeria did not give in to COVID-19 vaccine disinformation such as: Be warned; COVID-19 vaccines are biological weapons, COVID-19 vaccines are developed to reduce African population; don't take any of them, COVID-19 vaccines are meant to alter genetic makeup of people; avoid them, COVID-19 vaccines will only make the western world richer; so, it not necessary to take any of them, COVID-19 vaccines are ordinary mixture of multivitamins; Please go natural, Be warned; COVID-19 vaccines trigger hypertension, COVID-19 vaccines trigger heart attack. Please, avoid them, and many people died as a result of taking COVID-19 vaccine than of the disease itself. This suggests that many of the LIS professionals in Nigeria were not victims of COVID-19 vaccine misinformation and disinformation. Furthermore, it equally suggests that probably, many of them had adequate information literacy skills. More so that Prabagar et al. (2022) opined that COVID-19 vaccine disinformation remains an enemy to a healthy society.

Further findings revealed that the extent of COVID-19 Vaccine hesitancy among LIS professionals in Nigeria was at a low level, generally. For instance, more than half of them believed they needed the vaccine, they were interested in taking the vaccine, and eventually took the vaccine but delayed taking the vaccine because they were sceptical about its effectiveness and side effects. This indicates that the majority of the LIS professionals were well informed to make positive and appropriate decision to take COVID-19 vaccine, though not quickly. In all, a little above one third, 34.4% of them were yet to take the vaccine. This corroborates the findings of Troiano and Nardi (2021) that vaccine hesitancy occurred among people based on certain scepticism towards the safety of the COVID-19 vaccine.

The study has shown a significant relationship between COVID-19 vaccine misinformation, disinformation and COVID-19 vaccine hesitancy. Findings have revealed that COVID-19 vaccine misinformation had a very strong relationship with COVID-19 vaccine disinformation. Both COVID-19 vaccine misinformation and COVID-19 vaccine disinformation had positive effect on COVID-19 vaccine hesitancy. This suggests that greater the level of COVID-19 vaccine misinformation and COVID-19 vaccine disinformation, the greater the level of COVID-19 vaccine hesitancy. This corroborates the submission of Gisondi, et al. (2022) that vaccine hesitancy and vaccine refusal are triggered by COVID-19 misinformation and disinformation. A striking finding is that COVID-19 vaccine misinformation had more positive effect ($\beta = 0.357$, $p = 0.001$) on COVID-19 vaccine hesitancy than COVID-19 vaccine disinformation had ($\beta = 0.235$, $p = 0.027$). This corroborates the submission of Loomba et al. (2021) that misinformation is more strongly associated with declines in vaccination intent.

Conclusion

The research model has expounded and confirmed relationships among COVID-19 vaccine misinformation, disinformation, and COVID-19 vaccine hesitancy. This study contributes to the existing knowledge on the effect of COVID-19 vaccine misinformation, disinformation, on COVID-19

vaccine hesitancy even at a low level. This suggests that even a slight acceptance of misinformation and disinformation is detrimental to disease curtailing initiative such as vaccination. Thus, LIS professionals should be agents of positive change by creating necessary awareness that could spur high detection of misinformation and disinformation. Other relevant stakeholders should step up initiatives in this regard. Efforts should be geared towards curbing disinformation and misinformation because they pose a grave danger to public health now and in the future. There should be sanctions to an individual, groups of individuals and organisations spreading anti-vaccine information (i.e. misinformation and disinformation).

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