EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 12
13-26
Year: 2022

DIGITAL HEALTH LITERACY AND VACCINE HESITANCY AMONG DIFFERENT AGE GROUPS: A CROSS SECTIONAL STUDY IN MALAYSIA 2021

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Article Received on 22/09/2022 **Article Revised on 12/10/2022** **Article Accepted on 03/11/2022**

ABSTRACT

Introduction: Digital literacy provides a critical platform for disseminating current knowledge about COVID-19 disease and vaccination. Through internet literacy, information about COVID-19 sickness and COVID-19 vaccine spread as quickly as the disease itself, especially among Malaysians. The overall goal of this study is to look into the relationship between digital health literacy and vaccine apprehension among Malaysians of various ages. **Methods:** A total of 1524 Malaysian citizens above 18 years old participated in this cross-sectional web based online survey. Standardized questions were generated using Google form and the link was distributed through social media platforms. Development of Digital Health Literacy (DDHL) was used to assess and generate the questionnaire on digital health literacy among the target population in the study. All data analysed by SPSS (Statistical Package for Social Sciences-version 26). Descriptive analysis, chi-square analyses and binary logistic regression model analysis were carried out. **Results:** 1500 respondents were recruited in this study. Among them, 24 out of 1524 respondents were not counted in this survey as they did not give consent prior answering the questionnaire. Majority of respondents, almost 75% coming from adults age group, and followed by young adults with 15%. The smallest percentage was contributed by the old adults age group with only 5%. Many factors were observed that can promote vaccine hesitancy. Examples include age, gender, amount of money at their disposal, educational status, and digital health literacy. **Conclusion:** There are several opinions and also perspectives regarding the vaccine among different age group in Malaysia and also many associations seen to be linked with their hesitancy to accept the vaccination whether it can be from social media influence, peer pressure, level of knowledge and literacy of literature.

KEYWORDS: Digital health literacy, Adults, COVID-19 vaccine, Vaccine hesitancy, Different age groups, Malaysia.

INTRODUCTION

Malaysia is facing an outbreak of COVID-19 that emerged in December 2019 and spread to the rest of the world until now. Coronavirus disease (COVID-19) is a family of SARS-CoV-2 that started spreading in 2019. On May 6, 2020, 84,407 cases and 4643 deaths were confirmed in China. The nation China, has been impacted terribly and poured their concern since the nation declared pandemics.[1]

Digital literacy gives a platform for updated information about COVID-19 disease and COVID-19 vaccine. Digital literacy like social media have been recognized as important platforms for health-promoting practices in public health, e-platform has been a must providing platform in today's community around the nation. Despite the pandemics, the influence of social platforms in promoting health education about covid-19 is vital.[2] s. However, the influence of global networking has

grown beyond the platforms and the key to communication among Covid-19 patients is the characteristics of pandemics. The growth of health pandemics updates has been drastically increasing in the discussions among the community on non-health platforms.[3]

Vaccines invented to protect against COVID-19 proportionate with the spreading of COVID-19 diseases. Vaccines have saved uncounted lives and enhanced health and wellbeing over the world. Furthermore, vaccines capable of reducing mortality reduce severity.[4] According to that, acceptance of vaccination is typical and most common in the large populations all around the world, minorities rejected some vaccines but agree with others and some accept vaccination but are still confused in doing so.[5]

Information on COVID-19 virus and vaccines rapidly spread rapidly through digital literacy especially among Malaysian population and also vaccine hesitancy. 'Vaccine hesitancy' refers to refusal of vaccines despite their availability. The causes of vaccine hesitancy are various and involve socio-demographic, contextual, physical, and psychosocial factors. In this study, vaccine hesitancy is caused by digital health literacy which is responsible as a platform for information about vaccines and diseases. Additionally, the reasons for vaccine hesitancy vary depending on age. For example, older adults' vaccine hesitancy can cause big changes to their health and health-related behaviours related to a range of psychosocial factors. Age-related decline in cognition could also be associated with vaccination decision making.[6]

The general objective of this research is to study relationship between digital health literacy and vaccine hesitancy among Malaysian with different age groups.

METHODS

Data Source

A cross-sectional study design was used to evaluate the association of digital health literacy with vaccine hesitancy among different age groups in Malaysia. The target population was Malaysian citizens who are currently staying in Malaysia and those who are 18 years old and above. An online survey was distributed through social media platforms such as Whatsapp, Facebook, Twitter and Instagram to gain respondents from 21st March until 21st April 2021. Raosoft, a sample size calculator was used to calculate the sample size of this survey, in which the estimated sample size was 385 with the population size of 22.8 million adults aged 18 and above in Malaysia as per 2020.

Data Collection

One set of questionnaire was used to gather the information about (1) participants' socio-demographics characteristics including age; residency; gender; marital status; race; religion; family income and educational status; employment status; (2) assessment for the level of Digital Health Literacy; (3) Vaccine Hesitancy; (4) association of Digital Health Literacy with Vaccine Hesitancy among different age groups in Malaysia. The participants were asked for informed consent before administration of the questionnaire. To prevent overlapping of the participants in our study, we would randomly select one of them for the analysis and use the replicate submissions to investigate the consistency or variability of submissions that we might expect from a participant. Knowing this might help to judge the quality of the data and the relevance of effects seen in the actual analysis.

Digital health literacy was evaluated using five of the seven subscales from the validated Digital Health Literacy Instrument (DHLI)[7], each including three items to be answered on a 4-point scale (eg, 1, very difficult; 4, very easy). The DHLI was adapted to the context of the COVID-19 pandemic (eg, "When you search the Internet for information on the coronavirus or related topics, how easy or difficult is it for you to…"). The five subscales include (1) searching the web for information on COVID-19, (2) adding self-generated content on COVID-19, (3) evaluating the reliability of COVID-19–related information, (4) determining personal relevance of COVID-19–related information, and (5) protecting privacy on the internet. The internal consistency (Cronbach α) of the first four subscales was acceptable to good ($.70<\alpha<.83$). Due to low reliability ($\alpha=.46$), scaling was omitted for the protecting privacy subscale.[7]

For vaccine hesitancy, it was assessed using COVID-19 survey tool and guidance from the WHO Regional Office of Europe.[8] The first question will be further divided into three sub-questions in which the respondents need to share their position on COVID-19 vaccine. Respondents can choose the answer based on a 4-point scale (eg, 1, strongly disagree; 4, strongly agree). There were two multiple response questions (eg, "If a COVID-19 vaccine is made available in my country, my decision of whether or not to get vaccinated would depend on..." and "Where would you prefer to get a COVID-19 vaccine?") prepared for the respondents and they can choose the options given as many as they want. Majority of the questions in this section will be using the 7-point Likert scale (eg, 1, strongly disagree; 7, strongly agree). The internal consistency (Cronbach α) was found to be acceptable ($\alpha = 0.854$).[8]

Ethical Issues

The study was reviewed and approved by the Human Research Ethics Committee of Asia Metropolitan University under report AMU/MREC/FOM/2021/13), which is in accordance with the Declaration of Helsinki. The sample was selected based on specific criteria in a non-probability purposive sampling technique. Prior to the survey, the respondents had been enlightened about particulars of the introduction, objectives, and background of the study. Participation was fully

voluntary and no payment was available to the respondents. Respondents' information was kept confidential and will not be made public.

Statistical Analysis

A total of 1532 responses were received in this study. However, 2 respondents did not give informed consent. This made 1530 samples to be collected for analysis. The collected data were analyzed using Statistical Package for Social Sciences-version 26. Descriptive analysis, chi-square analyses and binary logistic regression model analysis were carried out. A p-value less than 0.05 was considered statistically significant. All variables that were significant in the chi-square tests were tested in binary logistic regression model analysis.

RESULTS

Mean age of respondents who participated in this questionnaire was around 28 years old. 80.93% mostly from urban areas and the rest from rural areas. Male had the highest participation with 50.3% while female only had 49.7%. Malay had the highest respondents by 52.7% followed by Chinese 20.3%. Most of the respondents were Muslim with 54.6% and followed by Hinduism 15.3%. (See Table 1).

Majority of the respondents selected no for the first question. 85.6% of total respondents selected not impaired when they were being asked the severity of the chronic illness. Other than that, more than 90% of total respondents did not have a chronic disease. Most of the respondents did search the information for themselves and other people as well for the last 4 weeks about COVID-19 vaccine by 53.1%. About 27.5% of the respondents had done the searching of information only for themselves about COVID-19 vaccine for the last 4 weeks. Majority of the respondents (47.4%) agreed that different websites can provide the same information. Almost half of the respondents (47.1%) found the information that they searched was applicable to the current pandemic situation. 49.0% of the total respondents found it easy to apply the information gathered in their daily life. 700 respondents did not find it difficult to formulate questions or health related worries. 53.5% of respondents never shared private information and only 2% often shared their private information. 49.7% of total respondents preferred English when researching information about COVID-19 vaccine and also relevant topics. 56.5% agreed that all this information about covid-19 is up to date to avoid any confusion or misunderstanding. 55.5% of the respondents agree that different opinions represented are very important. (See Table 2).

According to table 3, majority of young adults did not believe that administering vaccines can avoid the spread of Covid-19. 29.2% of adults had agreed that COVID-19 vaccine helps to prevent the spread of Covid-19. Both young adults and adults almost had the same value, around 80% agreed that everyone should be vaccinated according to the national vaccination schedule. 17.4% of middle adults did not agree that vaccines should be administered to everyone according to the schedule and this was followed by old age, in which 14.3%. Majority of the young adults' group will get vaccinated if it has been recommended by the Ministry of Health. Not only that, around 15% of young adults will also look at the countries in which the vaccine is produced. Other than that, there were three options that had a similar percentage of responses (4.1%) for the middle adults group. About 46% of adults strongly agree that it was important to get vaccinated for Covid-19 followed by old age at 42.9%. Only 1.3% of the young adults group strongly disagree at all about taking Covid-19 vaccine. 28.6% of old adults strongly agree that COVID-19 vaccine can cause serious reactions to their health followed by adults with 26.2%. The highest percentage of those who were not concerned if Covid-19 vaccine can have a serious reaction to them was contributed by the old adults' group, however, the highest number of respondents came from the adults' group with 32 respondents. More than 50% of young adults remain undecided whether Covid-19 vaccine is safe or not. Other three groups as well, with adults group (28.6%), middle adults group (30.6%), and old adults group (28.6%) had been selected to be neutral. Both middle adults and young adults' groups had small percentages in regards to their level of confidence and strongly agreed for the safety of COVID-19 vaccines, in which 12.4% and 5.1% respectively. Majority of the young adults group stayed neutral on this issue with 43.6%, followed by those who thought vaccination against Covid-19 is necessary with 12.4%. 25% of the adult group strongly agreed that vaccination against Covid-19 is necessary, in contrast to only 4.5% did not think Covid-19 vaccines should be administered. Old adults group held the highest percentage of strongly disagree with 35.7%, however, its number of respondents was the lowest compared to other age groups. For the young adults' group, it had 111 respondents (47.4%), followed by adults with 303 respondents (26.1%) and the middle adults group obtained 30 respondents (24.8%). Biggest percentage came out from the old adults' group was from those who selected somewhat agree with 35.7% equivalent to 5 respondents. Majority of young adults had decided to not state any opinion when being given a statement if they will weigh both benefits and risks before receiving the Covid-19 vaccine. The highest percentage of the adults' group was contributed from those who had chosen to strongly agree with this statement, around 30.4% or equivalent to 353 respondents. Furthermore, respondents from other three groups as well had more than 50% or almost 50% that selected strongly disagree, disagree and somewhat disagree when given the statement. Majority of young adults preferred taking the COVID-19 vaccine at the 'hospital' with 40.6% of responses and this was followed by 'health centre or clinic' with 28.2%. For the adults group, 475 respondents (40.9%) had selected 'health centre or clinic' as their preferred location to get the

COVID-19 vaccine while almost 20% of responses wanted to be administered the COVID-19 vaccine at the pharmacy. About 85.9% from young followed by old age at 85.7% heard something bad about COVID-19 vaccine. Comparing the percentage of adults and middle-aged adults which was still high regarding the statement, in which both had 82.7% and 82.6% respectively. However, there was a small percentage of every different age group that heard something bad about COVID-19 vaccine which was 14.1% for young adults, 17.3% of adults, 17.4% for middle adults and 14.3% for the old adults. (See Table 4)

Table 1: Sociodemographic Characteristics of the participants (N=1532).

Variables	Number (N= 1532)	Percentage (%)
Age	27.79 (±10.91)	
Residence		
Rural	293	19.1
Urban	1239	80.9
Gender		
Female	762	49.7
Male	770	50.3
Marital status		
Divorced	26	1.7
Married	297	19.4
Single	1184	77.3
Widowed	19	1.2
Others	6	0.4
Race		
Chinese	311	20.3
Indian	289	18.9
Malay	808	52.7
Others	124	8.1
Religion		
Agnostic	1	0.1
Buddhism	219	14.3
Christianity	167	10.9
Hinduism	234	15.3
Islam	836	54.6
None	1	0.1
Others	11	0.7
Family Income		
Less than RM4849	626	40.9
Between RM4850-RM10960	730	47.7
More than RM10960	176	11.5
Educational status		
No formal education	25	1.6
Primary	58	3.8
Secondary	134	8.7
Post secondary education (Pre-University, Matriculation, A-level, Diploma, Foundation etc.)	503	32.8
Tertiary (Bachelor, Degree, Master, PhD)	812	53.0
Employment status		
Employed (full time)	393	25.7
Employed (part time)	93	6.1
Housewife	1	0.1
Looking for jobs	37	2.4
Mangajah babi	1	0.1
Retired	24	1.6
Self employed	1	0.1
Student	852	55.6
Student with employment	1	0.1
Unemployed	45	2.9
Others	19	1.2

Table 2: Assessment for the level of Digital Health Literacy among participants (N=1532).

Variables	Number (N= 1532)	Percentage (%)
1. Have you search in the internet in the last 4 weeks about COVID-19 vaccine?		
No, I have not search any information for me and other people.	187	12.2
Yes, information for me and other people	814	53.1
Yes, only information for me	421	27.5
Yes, only information for other people	110	7.2
2. When you search the internet for information on COVID-19 vaccine, how easy or difficult for you to		
Make a choice from all the information you find?		
Very easy	324	21.1
Easy	698	45.6
Difficult	455	29.7
Very difficult	55	3.6
Use the proper words or search query to find the information you are looking for?		
Very easy	392	25.6
Easy	846	55.2
Difficult	235	15.3
Very difficult	59	3.9
Find the exact information you are looking for?		
Very easy	355	23.2
Easy	766	50.0
Difficult	352	23.0
Very difficult	59	3.9
Decide whether the information is reliable or not?		
Very easy	413	27.0
Easy	643	42.0
Difficult	391	25.5
Very difficult	85	5.5
Decide whether the information is written with commercial interests		
Very easy	360	23.5
Easy	647	42.2
Difficult	442	28.9
Very difficult	83	5.4
Check different websites to see whether they provide the same information?		
Very easy	398	26.0
Easy	726	47.4
Difficult	336	21.9
Very difficult	72	4.7
Decide if the information you found is applicable to you?	401	26.2
Very easy	721	47.1
Easy	345	22.5
Difficult	65	4.2
Very difficult		
Apply the information you found in your daily life?		
Very easy	406	26.5
Easy	750	49.0
Difficult	299	19.5
Very difficult	77	5.0
Use the information you found to make decisions about your health.		

Very easy	477	31.1
Easy	682	44.5
Difficult	321	21.0
Very difficult	52	3.4
3. Are you using social media		
Yes	1479	96.5
No	53	3.5
4.When typing a message about the COVID-19 vaccine, how easy or difficult is it for you to:		
Clearly formulate your question or health-related worry?		
Very easy	305	19.9
Easy	700	45.7
Difficult	505	33.0
Very difficult	22	1.4
Express your opinion, thoughts or feelings in writing?		
Very easy	428	27.9
Easy	729	47.6
Difficult	319	20.8
Very difficult	56	3.7
Write your messages as such for people to understand exactly what you mean?		
Very easy	423	27.6
Easy	693	45.2
Difficult	360	23.5
Very difficult	56	3.7
5. When you post a message about COVID-19 vaccine or related topics on a public forum or social media, how often :		
- Do you find it difficult to judge who can read along?		
Never	440	28.7
Once	547	35.7
Several time	495	32.3
Often	50	3.3
- Do you (intentionally or unintentionally) share your own private information (ex: name or address)?		
Never	820	53.5
Once	500	32.6
Several time	182	11.9
Often	30	2.0
- Do you (intentionally or unintentionally) share some else's private information?		
Never	946	61.7
Once	423	27.6
Several time	140	9.1
Often	23	1.5
6. What language do the sources you use for researching information COVID-19 vaccine and relevant topics have?		
Bahasa melayu	550	36.9
Chinese	151	9.9
Tamil	39	2.5
English	762	49.7
Others	31	2.0

7. Now it's about how important various things are to you when you search the Internet for COVID-19 vaccine and related topics. How important is it to you that:		
- The information is up to date?		
Very Important	865	56.5
Rather important	615	40.1
Rather not important	48	3.1
Not at all important	4	0.3
- The information is verified?		
Very Important	1170	76.4
Rather important	288	18.8
Rather not important	54	3.5
Not at all important	20	1.3
- You quickly learn the most important things?		
Very Important	921	60.1
Rather important	504	32.9
Rather not important	88	5.7
Not at all important	19	1.2
- The information comes from official sources?		
Very Important	1119	73.0
Rather important	337	22.0
Rather not important	54	3.5
Not at all important	22	1.4
- The different opinions are represented?		
Very Important	851	55.5
Rather important	550	35.9
Rather not important	94	6.1
Not at all important	37	2.4
- The subject is dealt with comprehensively?		
Very Important	1014	66.2
Rather important	385	25.1
Rather not important	90	5.9
Not at all important	43	2.8
8. How satisfied are you with the information you find on the Internet about COVID-19 vaccine?		
Very dissatisfied	50	3.3
Dissatisfied	113	7.4
Neutral	726	47.4
Satisfied	564	36.8
Very satisfied	79	5.2

Table 3: Assessment of Vaccine hesitancy among respondents (N=1532).

Variables	**Strongly disagree n(%)**	**Disagree n(%)**	**Neutral n(%)**	**Agree n(%)**	**Strongly agree n(%)**
I believe COVID-19 vaccine can help control the spread of COVID-19	162 (10.6)	159 (10.4)	488 (31.9)	406 (26.5)	317 (20.7)
If I knew I had been infected with COVID-19 before, I would not get COVID-19 vaccine	369 (24.1)	702 (45.8)	345 (22.5)	103 (6.7)	13 (0.8)
When everyone else is vaccinated against COVID-19, then I don't have to get vaccinated	474 (30.9)	665 (43.4)	285 (18.6)	91 (5.9)	17 (1.1)
Variables	**Number (N=1532)**			**Percentage (%)**	
2. Apart from COVID-19, I think everyone should be vaccinated according to the national vaccination schedule.					
Yes	1183			77.2	
No	143			9.3	
Don't Know	136			13.5	

3. If a COVID-19 vaccine is made available in my country, my decision of whether or not get vaccinated would depend on:		
- Country in which the vaccine is produced	335	21.9
- Recommendation from my family doctor	185	12.1
-Recommendation of the Ministry of Health	220	14.4
- Whether the vaccine has been in use for a long time with no serious side-effects	101	6.6
-Whether the vaccine is used in other countries	150	9.8
-Risk of getting infected with COVID-19 at the time when the vaccine is available	82	5.4
-How easy it is to get the vaccine	68	4.4
-Whether the vaccine is free of charge	69	4.5
-Whether a high vaccination uptake would lift restrictions on movement and gathering in groups	29	1.9
-Feedbacks from the people who get vaccinated.	80	5.2
-Whether will the government provide me compensation if anything had happened after vaccinated	61	4.0
-Whether getting vaccinated would allow me to safely see family and friends again	67	4.4
-Whether getting vaccinated would allow me to travel, go to concerts and other social activities again	85	5.5
4. How important do you think getting a COVID-19 vaccine will be for your health?	5.6 ± 1.4	
5. How concerned are you that a COVID-19 vaccine could cause you to have a serious reaction?	5.0 ± 1.6	
6. I am completely confident that the COVID-19 vaccine is safe.	4.7 ± 1.4	
7. Vaccination against COVID-19 is unnecessary because COVID-19 is not common anymore.	3.3 ± 1.7	
8. Everyday stress prevents me from getting vaccinated against COVID-19.	3.5 ± 1.6	
9. When I think about getting vaccinated against COVID-19, I weigh benefits and risks to make the best decision possible.	5.1 ± 1.7	
10. When everyone else is vaccinated against COVID-19, then I don't have to get vaccinated.	3.2 ± 1.9	
11. Where would you prefer to get a COVID-19 vaccine? Choose as many as apply. - Hospital - Health centre/clinic - Workplace - Pharmacy - Community centre, meeting hall, or local shop - Somewhere else - Others - I don’t want the vaccine	 666 488 21 324 142 3 1 1	 43.5 31.9 1.4 21.1 9.3 0.2 0.07 0.07
12. I have seen or heard something bad about COVID-19 vaccines. Yes No	 1275 257	 83.2 16.8

Table 4: Association of Vaccine hesitancy and different levels of age groups in Malaysia (N=1524)

Variables	Young adults n(%)	Adults n(%)	Middle adults n(%)	Old adults n(%)	Wald (df)	p-value
1. Please share your position on COVID -19 vaccine:						
- I believe COVID-19 vaccine can help control the spread of COVID-19.						
Agree	24(10.3)	339(29.2)	36(29.8)	7(50.0)		
Disagree	13(5.6)	114(9.8)	29(24.0)	3(21.4)	367.928	**0.001*** **
Neutral	72(30.8)	383(33)	29(24.0)	3(21.4)	(12)	
Strongly agree	23(9.8)	269(23.2)	24(19.8)	1(7.1)		
Strongly disagree	102(43.6)	56(4.8)	3(2.5)	0(0.0)		
- If I knew I had been infected with COVID-19 before, I would not get COVID-19 vaccine.						
Agree	14(6.0)	69(5.9)	17(14.0)	3(21.4)		
Disagree	126(53.8)	533(45.9)	39(32.2)	2(14.3)	43.273	**0.001*** **
Neutral	56(23.9)	252(21.7)	30(24.8)	7(50.0)	(12)	
Strongly agree	0(0.0)	11(0.9)	2(1.7)	0(0.0)		
Strongly disagree	38(16.2)	296(25.5)	33(27.3)	2(14.3)		
- When everyone else is vaccinated against COVID-19, then I don't have to get vaccinated						
Agree	5(2.1)	70(6.0)	15(12.4)	1(7.1)		
Disagree	123(52.6)	494(42.5)	43(35.5)	3(21.4)		
Neutral	55(23.5)	199(17.1)	25(20.7)	6(42.9)	47.789	**0.001*** **
Strongly agree	0(0.0)	13(1.1)	4(3.3)	0(0.0)	(12)	
Strongly disagree	51(21.8)	385(33.2)	34(28.1)	4(28.6)		
2. Apart from COVID-19, I think everyone should be vaccinated according to the national vaccination schedule.						
Yes	187(79.9)	906(78.0)	82(67.8)	6(42.9)		
No	13(5.6)	107(9.2)	21(17.4)	2(14.3)	68.140	**0.001*** **
Don't Know	14(6.0)	103(8.9)	8(6.6)	0(0.0)	(9)	
3. If a COVID-19 vaccine is made available in my country, my decision of whether or not get vaccinated would depend on:						
- Country in which the vaccine is produced	35(14.9)	89 (7.7)	7 (5.8)	1 (7.1)		
- Recommendation from my family doctor	12(5.1)	35 (3.0)	13(10.7)	3 (21.4)		
-Recommendation of the Ministry of Health	106(45.3)	211 (18.2)	25 (20.7)	6 (42.9)		
- Whether the vaccine has been in use for a long time with no serious side-effects	20 (8.5)	55 (4.7)	21(17.4)	1 (7.1)		
-Whether the vaccine is used in other countries	19 (8.1)	96 (8.3)	5 (4.1)	1 (7.1)		
-Risk of getting infected with COVID-19 at the time when the vaccine is available	18 (7.7)	85 (7.3)	9 (7.4)	0		
-How easy it is to get the vaccine	10 (4.3)	73 (6.2)	3 (2.5)	0		
-Whether the vaccine is free of charge	15 (6.4)	82 (7.0)	5 (4.1)	1 (7.1)	1866.27	0.146
-Whether a high vaccination uptake would lift restrictions on movement and gathering in groups	23(9.8)	92 (7.9)	3 (2.5)	0	(1803)	
-Feedbacks from the people who get vaccinated.	23 (9.8)	127 (10.9)	7 (5.8)	1 (7.1)		
-Whether will the government provide me compensation if anything had happened after vaccinated	10 (4.3)	74 (6.3)	5 (4.1)	0		
-Whether getting vaccinated would allow me to safely see family and friends again	25 (10.7)	84 (7.2)	9 (7.4)	0		
-Whether getting vaccinated would allow me to travel, go to concerts and other social activities again	22 (9.4)	58 (5.0)	9 (7.4)	0		
4. How important do you think getting a COVID-19 vaccine will be for your health?						
Strongly disagree	3(1.3)	11(0.9)	2(1.7)	0(0.0)		

Disagree	2(0.9)	19(1.6)	1(0.8)	0(0.0)	171.374 (18)	**0.001*** **
Somewhat Disagree	5(2.1)	49(4.2)	9(7.4)	2(14.3)		
Remain undecided	100(42.7)	165(14.2)	18(14.9)	1(7.1)		
Somewhat agree	58(24.8)	178(15.3)	25(20.7)	1(7.1)		
Agree	32(13.7)	205(17.7)	32(26.4)	4(28.6)		
Strongly agree	34(14.5)	534(46.0)	34(28.1)	6(42.9)		
5. How concerned are you that a COVID-19 vaccine could cause you to have a serious reaction?						
Strongly disagree	3(1.3)	32(2.8)	9(7.4)	4(28.6)	122.088 (18)	**0.001*** **
Disagree	9(3.8)	61(5l.3)	3(2.5)	0(0.0)		
Somewhat Disagree	6(2.6)	79(6.8)	10(8.3)	1(7.1)		
Remain undecided	108(46.2)	258(22.2)	36(29.8)	2(14.3)		
Somewhat agree	54(23.1)	241(20.8)	25(20.7)	2(14.3)		
Agree	34(14.5)	186(16.0)	15(12.4)	1(7.1)		
Strongly agree	20(8.5)	304(26.2)	23(19.0)	4(28.6)		
6. I am completely confident that the COVID-19 vaccine is safe.						
Strongly disagree	1(0.4)	15(1.3)	2(1.7)	0(0.0)	88.373 (18)	**0.001*** **
Disagree	2(0.9)	55(4.7)	6(5.0)	0(0.0)		
Somewhat Disagree	11(4.7)	169(14.6)	16(13.2)	1(7.1)		
Remain undecided	132(56.4)	332(28.6)	37(30.6)	4(28.6)		
Somewhat agree	44(18.8)	234(20.2	29(24.0)	3(21.4)		
Agree	32(13.7)	193(16.6)	16(13.2)	2(14.3)		
Strongly agree	12(5.1)	163(14.0)	15(12.4)	4(28.6)		
7. Vaccination against COVID-19 is unnecessary because COVID-19 is not common anymore.						
Strongly disagree	29(12.4)	290(25.0)	18(14.9)	5(35.7)	84.084 (18)	**0.001*** **
Disagree	31(13.2)	183(15.8)	15(12.4)	0(0.0)		
Somewhat Disagree	12(5.1)	154(13.3)	18(14.9)	1(7.1)		
Remain undecided	101(43.2)	271(23.3)	32(26.4)	2(14.3)		
Somewhat agree	39(16.7)	138(11.9)	20(16.5)	2(14.3)		
Agree	18(7.7)	73(6.3)	12(9.9)	4(28.6)		
Strongly agree	4(1.7)	52(4.5)	6(5.0)	0(0.0)		
8. Everyday stress prevents me from getting vaccinated against COVID-19.						
Strongly disagree	20(8.5)	188(16.2)	14(11.6)	4(28.6)	118.853 (18)	**0.001*** **
Disagree	24(10.3)	219(18.9)	9(7.4)	1(7.1)		
Somewhat Disagree	21(9.0)	205(17.7)	19(15.7)	1(7.1)		
Remain undecided	111(47.4)	303(26.1)	30(24.8)	0(0.0)		
Somewhat agree	35(15.0)	136(11.7)	26(21.5)	5(35.7)		
Agree	21(9.0)	54(4.7)	17(14.0)	3(21.4)		
Strongly agree	2(0.9)	56(4.8)		0(0.0)		
9. When I think about getting vaccinated against COVID-19, I weigh benefits and risks to make the best decision possible.						
Strongly disagree	3(1.3)	47(4.0)	6(5.0)	2(14.3)	63.890 (18)	**0.001*** **
Disagree	4(1.7)	59(5.1)	7(5.8)	0(0.0)		
Somewhat Disagree	4(1.7)	88(7.6)	10(8.3)	2(14.3)		
Remain undecided	79(33.8)	227(19.6)	25(20.7)	0(0.0)		
Somewhat agree	50(21.4)	190(16.4)	18(14.9)	1(7.1)		
Agree	50(21.4)	197(17.0)	22(18.2)	4(28.6)		
Strongly agree	44(18.8)	353(30.4)	33(27.3)	5(35.7)		
10. When everyone else is vaccinated against COVID-19, then I don't have to get vaccinated.						
Strongly disagree	42(17.9)	332(28.6)	19(15.7)	5(35.7)		
Disagree	59(25.2)	220(18.9)	19(15.7)	1(7.1)		
Somewhat Disagree	22(9.4)	119(10.2)	14(11.6)	1(7.1)		

Remain undecided Somewhat agree Agree Strongly agree	72(30.8) 23(9.8) 11(4.7) 5(2.1)	217(18.7) 102(8.8) 106(9.1) 65(5.6)	27(22.3) 16(13.2) 19(15.7) 7(5.8)	1(7.1) 1(7.1) 3(21.4) 2(14.3)	58.497 (18)	**0.001*** **
11. Where would you prefer to get a COVID-19 vaccine? Choose as many as apply. - Hospital - Health centre/clinic - Workplace - Pharmacy - Community centre, meeting hall, or local shop - Somewhere else - Others - I don't want the vaccine	 95 (40.6) 66 (28.2) 5 (2.1) 14 (5.9) 52 (22.2) 1 (0.4) 0 (0.0) 1 (0.4)	 149 (12.8) 475 (40.9) 135(11.6) 231(19.9) 123 (10.6) 23 (2.0) 1 (0.1) 24 (2.1)	 26 (21.5) 34 (28.1) 38 (31.4) 6 (4.9) 10 (8.3) 3 (2.8) 0 (0.0) 4 (3.3)	 1 (7.1) 6 (42.9) 1(7.1) 3 (21.4) 1 (7.1) 2 (14.2) 0 (0.0) 0 (0.0)	 595.67 (255)	 **0.001**
12. I have seen or heard something bad about COVID-19 vaccines. Yes No	 201(85.9) 33(14.1)	 960(82.7) 201(17.3)	 100(82.6) 21(17.4)	 12(85.7) 2(14.3)	 1.527 (3)	 0.676

DISCUSSION

The aim of this research was to evaluate the association of digital health literacy with vaccine hesitancy among different age groups in Malaysia. Many significant findings in regard to this research were managed to be collected and reviewed. We first examined how vaccine hesitancy varies with age, in which more than 50% of the adults, middle adults and old adults group were willing to get vaccinated for COVID-19. However, only 30% of the young adults group thought that COVID-19 vaccine was important for them. These findings have resemblance to another study that was done in the United Kingdom and Germany.[9]

Age is an important driver of vaccine intent and older people are much more willing to get vaccinated against COVID-19.[9] This is not entirely surprising, since COVID-19 mortality and morbidity increases exponentially with age[10],[11], and the initial public health messaging on vaccines focused heavily on raising awareness and building trust among older individuals. Our analyses suggested that those with higher vaccine resistance or hesitancy are more likely to have a set of strongly held beliefs, a lack of trust in those responsible for health (state or territory government and hospitals or health systems) and lower levels of compliance with public health advice for COVID-19 (e.g. lower levels of social distancing, not downloading the COVID-Safe App).[12]

Not only that, only 15% of the young adults group believed that COVID-19 vaccines are safe. Different results can be observed for the other three groups, in which more than one quarter of respondents were confident of the safety of COVID-19 vaccines. According to the findings of our study, as the age increased, vaccine acceptance increased.[13] In our country, it is possible that the restrictive measures regarding the pandemic that covers over 65 years of age and continuing for a long time and the news about the disease mortality specific to this age group in the media might have affected the vaccine acceptance of the elderly group.[13] As the subjective perception of personal risk increases, the rate of acceptance of the vaccine increases. However, there are also studies where acceptance is higher in the young age group, and adverse results are associated with higher anxiety and easier access to more information in young people.[14] There is an evident uncertainty clouding the COVID-19 vaccines. Firstly, the new mRNA-based vaccines as a novel technology could be received with some skepticism since no prior experience or successes with such approach have been reported in the past. Also, the speed of vaccine development and registration in less than a year may have mediated a role in lowering the acceptance level.[15] This is consistent with Pogue and colleagues finding where the majority of participants (~63%) in the USA stated that they were worried about the side effects of the COVID-19 vaccines.[16]

Vaccination is one of the most successful public health interventions.[17],[18] It has led to the elimination and control of diseases that were once common in Canada.[17] Malaysia is now becoming one of the leading countries in Southeast Asian with more than 14 million people who had been administered their first and second doses in total up to 20st July 2021 and that was enough to obtain a vaccination rate of 23.1% of the country's population.[19] Not only that, Malaysian government also has scheduled types of vaccine that can be used as mentioned in National COVID-19 Immunisation Programme, for example AstraZeneca with doses ordered as many as 12.8 million, Pfizer (32 million), Sinovac (12 million) and these 3 vaccines have been distributed to every states in Malaysia.[20] There are several factors making contributions in vaccine acceptance, for example contribution from media and its contents, religion and culture, sociodemographic, leaders, pharmaceutical companies and also perception on risk and benefits from the Malaysian citizens.[21]

Rapid development of vaccine productions and also public acceptance must go together, so building trust in the COVID-19 vaccine is crucial among countries around the globe. The government plays a huge role in enhancing public trust by working together with Non-governmental organizations (NGOs) to promote the effectiveness and safety of the vaccine through effective communication as well as their role to procure and distribute the vaccines effectively.[22] More broadly, this pandemic has caused vast disinformation regarding vaccination programmes which absolutely will retard our herd immunity slogan.[22] Malaysian government also has imposed several policies to entrust the folks by special conference of Muzakarah of National Council for the Islamic Religious Affairs (MKI) had decided that the use of the COVID-19 vaccine is permissible without unknown ingredients and law also have been implemented to build people's trust and urge people the need of vaccination by Poisons Act 1952 (Act 366) and its regulations, Sale of Drugs Act 1952 (Act 368) and its regulations , Drugs and Cosmetic Control Regulations 1984 , Infectious Disease Prevention and Control Act (Act 342). The government has taken an integrated and structured approach in its vaccine acquisition effort for the country by leveraging on its diplomatic relations and strategic international cooperation with countries, vaccine manufacturers as well as world health bodies and affiliates.[23]

A cross sectional study conducted in the US among its 1000 respondents found that 3 major contributing factors in vaccine acceptance are 1) the probability of COVID-19 vaccine against coronavirus infection, 2) its minor side effect and 3) serious adverse reaction.[24] Studies from other countries also have identified contributing factors toward vaccine hesitancy among their populations. These include the risk perception of the disease, perception of vaccine safety and efficacy, past vaccination and also doctors recommendation.[24]

Our research found that the majority of all age groups had seen and heard negative rumours about COVID-19 vaccine. This finding is consistent with previously reported findings, in which it was found that the majority of respondents in Africa (79%) would be vaccinated against COVID-19 if it were deemed safe and effective.[25] Highest number of respondents came from the adults group with 960 respondents followed by the young adults. Governments should be transparent about their COVID-19 response programs and vaccine availability and should disclose how key decisions are being made. Reporting of adverse events after immunization is a key component of monitoring the implementation of vaccination programs, and although it is important for these events to be documented and reported, intensive media coverage may also discourage people from being vaccinated.[25]

The decision to get vaccination against COVID-19 can be associated with stress level. It is remarkable that COVID-19-related anxiety and health-related fears were associated with a higher willingness, whereas the fear of social and economic consequences showed the contrary direction. It seems plausible that fears that are directly related to the physical health of oneself or loved ones are associated with a higher acceptance of a vaccination that promises to reduce the probability of those negative outcomes.[26] Specifically, COVID-19 vaccine hesitant or resistant persons were distinguished from their vaccine accepting counterparts by being more self-interested, more distrusting of experts and authority figures (i.e. scientists, health care professionals, the state), more likely to hold strong religious beliefs (possibly because these kinds of beliefs are associated with distrust of the scientific worldview) and also conspiratorial and paranoid beliefs (which reflect lack of trust in the intentions of others).[27]

LIMITATIONS

Data collection was done via online, which means we may not have reached vulnerable groups, including those with lower socioeconomic background and those who are illiterate. Also, a larger percentage of the respondents came from a single geographic area, which may impact the generalisation of the survey results and not only that, participation from rural areas may be limited due to poor internet connections. Furthermore, this online survey is not multilingual so only people with English literacy could answer the questions given and we can not get the precise number of realistic data from varieties of age and also races regarding their hesitancy.

CONCLUSION

This study was conducted to address the relation between the digital health literacy and its association with the different age group toward vaccine hesitancy. Data interpreted leaned toward the vaccine acceptance, benefits and so on is varied. Most older folks show a positive response regarding the vaccination program compared to the younger generation when they mostly become neutral and somewhat agree to certain questions. Adult and middle age groups mostly tend to be positive in accepting the vaccination. For younger generations, the varieties of response can be due to their perspective that young generations have a high level of protection against viruses compared to the old one.

AVAILABILITY OF DATA AND MATERIALS

The datasets generated and/or analyzed during the current study are not publicly available due to confidentiality; however, data is accessible from the corresponding author on reasonable request.

ABBREVIATIONS

SD : Standard Deviation
SPSS : Statistical Package for Social Sciences Software
95% CI: 95% Confident Interval
df : Degree of freedom

ACKNOWLEDGEMENT
We would like to extend our heartfelt thanks to the participants of this study. We also would like to thank the Centre of Research and Development, Asia Metropolitan University for approval of our research ethic application. This topic had helped us in doing a lot of research and to know about multiple innovations. Any attempt at any level cannot be satisfactorily completed without the support and guidance from supervisors and colleagues.

FUNDING
There is no funding.

Author's Contributions
TK, LLW, YMH, RM, HA, and FS devised the project, the main conceptual ideas, and proof outline. TK, LLW, HA, FS collected and analyzed the data. TK, RM, YMH, UM and HA contributed to the interpretation of the results. TK and UM took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis, and manuscript. The author(s) read and approved the final manuscript.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE
The study was reviewed and approved by the Research Ethics Committee of Asia Metropolitan University under report AMU/MREC/FOM/2021/13), which is in accordance with the Declaration of Helsinki. The sample was selected based on specific criteria in a non-probability purposive sampling technique. Prior to the survey, the respondents had been enlightened about particulars of the introduction, objectives, and background of the study. Participation was fully voluntary and no payment was available to the respondents. Respondents' information was kept confidential and will not be made public.

CONSENT FOR PUBLICATION
Not applicable.

COMPETING INTERESTS
The authors declare that they have no competing interests.

CONFLICT OF INTEREST
None declared.

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