INTRODUCTION

COVID-19/Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has become a major public health challenge for the whole world. With initial cases reported from Wuhan city in China in December 2019, the pandemic is still raging. WHO Director-General Dr. Tedros, says there must be a ‘new normal’ a world that is healthier, safer and better prepared.¹

Globally, as of 2nd November 2021, there are 246,951,274 confirmed cases of COVID-19, including 5,004,855 deaths, reported to WHO. India reports 34,308,140 confirmed cases and 4,59,191 deaths.² There are 49,68,657 confirmed cases in Kerala, of which 1.16% are active cases. The recovery rate is 97.76% and death rate is 0.64%. The test positivity rate is 11%.³

Kerala model of healthcare is known worldwide. The experience and investment made in disaster preparedness and emergency response in the past during Kerala floods in 2018 and Nipah outbreak in 2019 helped the government of Kerala to act promptly in the COVID-19 situation. In collaboration with the key stake holders, the state formulated innovative approaches to deploy resources and put up a timely and comprehensive response.⁴ Inspite of all these efforts and praise from international community in the initial phase, the state’s pandemic curve is now defying all predictions. It is one among the top five states in India with the highest number of COVID-19 cases.⁵

With the development of vaccines, there seems to be a new ray of hope for the world to fight the pandemic out. The introduction of various vaccines within a short span of one year is undoubtedly a great achievement. This is welcomed
Objective

The objectives of this study were (a) to study the attitude of healthcare workers towards COVID-19 vaccination; and (b) to find out the practice of COVID-19 vaccination among HCW.

Methods

This was a descriptive study done to assess the attitude and practice towards COVID-19 vaccination among healthcare workers in Kerala. It was done during the period of April 2021-May 2021. Taking 36% as the prevalence of vaccine acceptance among healthcare workers and 10% absolute precision, a sample size of 93 was obtained, which was rounded off to 100.9 Convenience sampling was done to recruit the study participants. Data was collected using a semi structured questionnaire which had two parts: part-1 included questions about personal details and socio-demographic information such as age, address, phone number, type of family, religion, education, previous history of COVID-19. Part-2 included questions about determinants, attitude and practice regarding COVID-19 vaccination. It was converted to Google forms which were administered via WhatsApp or e-mail to all healthcare workers in the personal contacts. All 126 people who responded were included in the study. The data was analyzed using Epi info software.

Results

The age group of the study population varied from 22 to 68 years with a mean age of 31.60±7.8 SD years. Out of the 126 healthcare professionals who took part, majority (51.6%) were Hindus and 61.9% were females. Most of them (81.7%) were modern medicine practitioners and majority (87.3%) had no co-morbidities. Baseline characteristics of the study population are shown in Table 1.

Table 2 shows the COVID-19 related information of the study participants. 14.3% had a previous history of confirmed COVID-19 and 17.5% gave a family history of COVID-19. Majority (73.8%) had been involved in dealing with COVID-19 patients. Majority (76.9%) relied on WHO official website for information related to COVID-19.

Table 3 shows the attitude on each aspect related to COVID-19 vaccination among study participants. 118 (93.6%) of the participants agreed that it was fair to vaccinate HCW in the initial phase. The reasons were- they were frontline workers with the highest risk, so they deserved it first (103, 81.7%), vaccinated HCW could treat patients better (5, 3.9%), if HCW fell ill, there would be shortage of staff to look after patients (4, 3.1%), vaccinated HCW could do work without fear of COVID-19 (3, 2.3%), it would build confidence among public regarding vaccination (2, 1.5%) and as it was a government order, we were supposed to obey (1, 0.7%). 2 (1.5%) were neutral and 6 (4.8%) disagreed to vaccinating HCW first. If there were serious adverse effects, it would knock out frontline workers (2, 1.5%), not enough trials had been done on these vaccines (2, 1.5%), experimenting with HCW was not fair (1, 0.7%) and more efficient vaccines would be invented later (1, 0.7%) were the reasons for disagreement.

Concerns regarding COVID-19 vaccine are shown in Table 4. In the present study, 81.7% had taken vaccine and 79.6% had some adverse effects following vaccination. Table 5 shows their preference for other vaccines. Table 6 explains the practice regarding vaccination. Table 7 enlists the adverse effects experienced by vaccines and Table 8 shows the motivating factors for vaccination and Table 9, what vaccines felt after taking COVID-19 vaccination.

Table 1: Baseline characteristics of the study population (n=126).

| Variables               | Frequency | Percent |
|-------------------------|-----------|---------|
| Sex distribution        |           |         |
| Females                 | 78        | 61.9    |
| Males                   | 48        | 38.1    |

Continued.
| Variables                          | Frequency | Percent |
|-----------------------------------|-----------|---------|
| **Age group (years)**             |           |         |
| 20-29                             | 41        | 32.5    |
| 30-39                             | 73        | 57.9    |
| 40-49                             | 5         | 4.0     |
| 50-59                             | 5         | 4.0     |
| 60-69                             | 2         | 1.6     |
| **Religion**                      |           |         |
| Hindu                             | 65        | 51.6    |
| Christian                         | 39        | 30.9    |
| Muslim                            | 20        | 15.9    |
| Nil                               | 2         | 1.6     |
| **Profession**                    |           |         |
| Modern medicine practitioner      | 103       | 81.7    |
| Nursing                           | 9         | 7.1     |
| B pharm (Pharmacy)                | 4         | 3.2     |
| Dental surgeon                    | 4         | 3.2     |
| Ayurveda/homeo practitioner       | 2         | 1.6     |
| Others                            | 4         | 3.2     |
| **Place of work**                 |           |         |
| Government hospital               | 64        | 50.8    |
| Private sector                    | 62        | 49.2    |
| **Comorbidity#**                  |           |         |
| Bronchial asthma                  | 10        | 7.9     |
| Dyslipidemia                      | 3         | 2.3     |
| Diabetes mellitus                 | 2         | 1.6     |
| Hypertension                      | 2         | 1.6     |
| Hypothyroidism                    | 1         | 0.8     |
| Obstructive sleep apnoea          | 1         | 0.8     |
| Coronary heart disease            | 1         | 0.8     |
| None                              | 110       | 87.3    |

Note: # - not mutually exclusive.

**Table 2: COVID-19 related information of the study participants (n=126).**

| Variables                                          | Frequency | Percent |
|----------------------------------------------------|-----------|---------|
| **Previous history of confirmed COVID-19**         |           |         |
| No                                                 | 108       | 85.7    |
| Yes                                                | 18        | 14.3    |
| **Family history of COVID-19**                     |           |         |
| No                                                 | 104       | 82.5    |
| Yes                                                | 22        | 17.5    |
| **Have you ever been involved in dealing with COVID-19 patients?** | | |
| No                                                 | 33        | 26.2    |
| Yes                                                | 93        | 73.8    |
| **Source of information regarding COVID-19 vaccine#** | | |
| WHO official website                               | 97        | 76.9    |
| Newspaper/TV                                       | 42        | 33.3    |
| Peers                                              | 32        | 25.3    |
| MOHFW (Ministry of Health and Family Welfare)      | 16        | 12.6    |
| Journals                                           | 5         | 3.9     |
| YouTube, Instagram, Facebook                      | 4         | 3.1     |
| Experts                                            | 2         | 1.5     |
| IAP (Indian Association of pediatrics)             | 2         | 1.5     |
| IMA (Indian Medical Association)                   | 2         | 1.5     |
| ICMR (Indian Council of Medical Research)          | 2         | 1.5     |
| KGMOA (The Kerala Government Medical Officers’ Association) | 2       | 1.5     |

Note: # - not mutually exclusive.
Table 3: Attitude towards COVID-19 vaccination among the study population (n=126).

| No. | Questions                                                                 | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|-----|---------------------------------------------------------------------------|----------------|-------|---------|----------|------------------|
|     |                                                                           | N (%)          | N (%) | N (%)   | N (%)    | N (%)            |
| 1   | It is safe to take COVID-19 vaccine given in India                        | 48 (38.1)      | 70 (55.6) | 7 (5.6) | 1 (0.8)  | 0 (0)            |
| 2   | COVID-19 vaccine given in India is effective                              | 25 (19.8)      | 79 (62.7) | 20 (15.9) | 1 (0.8)  | 1 (0.8)            |
| 3   | COVID-19 vaccination is necessary to control the pandemic                 | 70 (55.6)      | 45 (35.7) | 10 (7.9) | 0 (0)    | 1 (0.8)            |
| 4   | Even without vaccination, the pandemic will subside on its own by developing herd immunity | 1 (0.8)       | 15 (11.9) | 36 (28.6) | 50 (39.7)  | 24 (19)            |
| 5   | Healthcare workers use proper infection control measures, so we are not at risk of developing COVID-19 like the general population | 6 (4.8)       | 16 (12.7) | 15 (11.9) | 53 (42.1)  | 36 (28.6)            |
| 6   | Healthcare workers deal more closely with COVID-19 patients than others, so we should be vaccinated | 81 (64.3)     | 38 (30.2) | 3 (2.4) | 1 (0.8)  | 3 (2.4)            |
| 7   | It is fair to vaccinate healthcare workers in the initial stage           | 77 (61.1)      | 41 (32.5) | 2 (1.6) | 6 (4.8)  | 0 (0)            |
| 8   | There is much hesitance regarding COVID-19 vaccination among health care workers | 2 (1.6)       | 27 (21.4) | 27 (21.4) | 62 (49.2)  | 8 (6.3)            |
| 9   | There is unnecessary fear regarding COVID-19 vaccination among health care workers | 2 (1.6)       | 27 (21.4) | 28 (22.2) | 61 (48.4)  | 8 (6.3)            |
| 10  | There is no need to practice infection control measures after receiving both the doses of vaccine | 1 (0.8)       | 1 (0.8)    | 2 (1.6) | 23 (18.3) | 99 (78.6)         |
| 11  | How long do you think will COVID-19 vaccine protection last?             | <1 month 1(0.8) | 1-3 months 28 (22.2) | 3 months-1 year 71 (56.3) | >1 year 26 (20.6) |
| 12  | Do you think Covaxin is safer than Covishield?                           | Yes 23 (18.3) | No 32 (25.4) | Don’t know 71 (56.3) |
| 13  | Do you wish your country provided some other COVID-19 vaccine other than Covishield and Covaxin? | Yes 70 (55.5) | No 55 (43.6) | Don’t know 1 (0.8) |
| 14  | Will you encourage others to take vaccine?                               | Yes 126 (100) | No 0 (0)    |

Table 4: Concerns regarding COVID-19 vaccine (n=126).

| Concerns#                          | Frequency | Percent |
|------------------------------------|-----------|---------|
| Duration of protection             | 77        | 61.1    |
| Protection against new strains     | 72        | 57.1    |
| Inadequate studies on long term effects | 60        | 47.6    |
| Inadequate clinical trials         | 34        | 26.9    |
| Commercial profiteering            | 31        | 24.6    |
| Adverse effects                    | 28        | 22.2    |
| Speed to market                    | 26        | 20.6    |
| Infertility                        | 5         | 3.9     |
| Nil                                | 0         | 0       |

Note: #-not mutually exclusive.
Table 5: Which vaccine do you wish your country provided other than Covishield and Covaxin? (n=126).

| Vaccine                       | Frequency | Percentage |
|-------------------------------|-----------|------------|
| Pfizer                        | 55        | 43.6       |
| Sputnik                       | 19        | 15.1       |
| Moderna                       | 11        | 8.7        |
| Johnson and Johnson           | 2         | 1.5        |
| Other new efficient vaccines  | 3         | 2.3        |
| Any mRNA vaccine              | 1         | 0.7        |
| German made vaccines          | 1         | 0.7        |
| Don’t know                    | 1         | 0.7        |
| None                          | 55        | 43.6       |

Table 6: Practice regarding COVID-19 vaccination.

| S. no. | Questions                                                                 | Responses                        | Planning to take soon |
|--------|---------------------------------------------------------------------------|----------------------------------|-----------------------|
| 1      | Have you taken COVID-19 vaccine? (N=126)                                  | Yes (81.7%)  No (7.1%)            | Planning to take soon |
| 2      | If you have taken vaccine, did you take it willingly (N=103)              | Yes, fully willing Somewhat hesitant | 98 (95.1%) 5 (4.8%)   |
| 3      | Reason for not taking vaccine (N=9)                                       | Not eligible for vaccine (allergy/pregnant/lactating/recent COVID-19 infection in the past two months/bleeding disorder) | 9 (100%)            |
| 4      | Did you experience any adverse effect following vaccination? (N=103)       | Yes (79.6%)  No (20.3%)           | 82 (79.6%) 21 (20.3%) |

Table 7: Adverse effects experienced after vaccination (n=103).

| Adverse effects                  | Frequency | Percent |
|----------------------------------|-----------|---------|
| Fever                            | 53        | 51.4    |
| Pain at site of injection        | 47        | 45.6    |
| Myalgia                          | 43        | 41.7    |
| Generalized body-ache            | 28        | 27.1    |
| Headache                         | 22        | 21.3    |
| Malaise                          | 23        | 22.3    |
| Nausea                           | 11        | 10.6    |
| Joint pain                       | 5         | 4.8     |
| Dizziness                        | 5         | 4.8     |
| Vomiting                         | 2         | 1.9     |
| Sleep                            | 1         | 0.9     |
| GERD                             | 1         | 0.9     |
| Rash                             | 1         | 0.9     |
| Rhinitis                         | 1         | 0.9     |
| Nil                              | 21        | 20.3    |

Note: #-not mutually exclusive.

Table 8: If has taken/planning to take vaccine, what was the strongest motivating factor for the same? (n=117).

| Motivation factors               | Frequency | Percent |
|----------------------------------|-----------|---------|
| Protection of self and family    | 97        | 82.9    |
| Protection of patients           | 8         | 6.8     |
| Protection of self and family, patients | 1   | 0.8     |
| because all healthcare workers are taking vaccine | 7 | 5.9 |
| All of the above                 | 1         | 0.8     |
| To be a role model as I’m an HCW | 1         | 0.8     |
| Herd immunity                    | 1         | 0.8     |

Continued.
Different dimensions of attitude among accepted and 51% were observed to have a more negative attitude whereas 23% thought that there was still much hesitance and fear regarding COVID-19 vaccination among HCW in Kerala. This again points to the fact that healthcare professionals in Kerala depended on reliable sources of information.

73.8% of the study participants were involved in dealing with COVID-19 patients. 14.3% had a previous history of confirmed COVID-19 and 17.5% had a family history of COVID-19. A muti-centric study in Canada showed that occupational COVID-19 exposure was independently associated with acceptance of COVID-19 vaccine. Another study in Egypt also revealed that those who dealt directly with COVID-19 patients were three times more likely to accept COVID-19 vaccine than others. Elhadi et al in their study also reported that if they had a family member or friend affected with COVID-19, it was positively associated with vaccine acceptance.

In the present study to see the general attitude and practice of healthcare workers regarding COVID-19 vaccine, it was seen that majority (91.3%) agreed that COVID-19 vaccine is necessary to control the pandemic and 81.7% had already taken and 11.1% were planning to take soon. Only 7.1% had not taken vaccine because they were not eligible for the same. The systematic review conducted by Hajure et al revealed that about two-thirds of the studies among healthcare workers showed a positive attitude (≥50%) towards COVID-19 vaccination. African and Asian studies were observed to have a more negative attitude whereas United Arab Emirates reported highest rate of acceptance. Another scoping review, by Biswas et al of 35 studies across the world reported that the prevalence of vaccine hesitancy among healthcare workers varied from 4.3 to 72%. Vaccine hesitancy was found among 10.6% of the medical students in India.

The results of the present study were in contrast to the studies done in Egypt where only 21% accepted and 51% of the participants were undecided and in Congo where only 27.7% of HCWs were willing to take COVID-19 vaccine. But a study done in China revealed 76.98% of the HCW accepted COVID-19 vaccine. A similar study done in India showed that 36% were willing to take the vaccine while 56% were not sure or would wait. 8% of them had no plans to get vaccine. Another study from India done among HCW in a tertiary care centre showed 92.7% had a positive attitude towards vaccine. Even though all the study participants in the present study had a positive attitude, 23% thought that there was still much hesitance and fear regarding COVID-19 vaccination among HCW in Kerala.

The present study stands out in the sense that it took into consideration different dimensions of attitude among HCW towards COVID-19 vaccination which other studies had not looked into. 93.7% of the study participants agreed that vaccines provided in India were safe and 82.5% thought they were effective. 58.7% disagreed that even without vaccination, the pandemic would subside on its own by developing herd immunity. 94.5% believed that since HCW deal more closely with COVID-19 patients, they should be vaccinated and 93.6% agreed that it was only fair to vaccinate them in the initial phase of the pandemic before the general population. Majority (81.7%) said as they were frontline workers with the highest risk, they deserved vaccination first. 96.9% had positive attitude towards practicing infection control measures even after vaccination.

Majority (56.3%) thought the protection of vaccine would last for 3 months to 1 year. All the study participants would recommend vaccination for others. This was in contrast to the study done by Fares et al where only 42.08% of the HCW were willing to do the same. This again points to the strong positive attitude among HCW in Kerala. This attitude also reflected on the good practice. This was again in line with the findings of the Egyptian study where HCW who recommended vaccination for others had 17 times

| Motivation factors                                      | Frequency | Percent |
|---------------------------------------------------------|-----------|---------|
| Studies showing hospitalization due to COVID-19, post-vaccination reduced drastically | 1         | 0.8     |

Table 9: If you have taken vaccine, how do you feel now? (n=103).

| How do you feel?                                      | Frequency | Percent |
|-------------------------------------------------------|-----------|---------|
| Feeling confident                                     | 42        | 40.7    |
| Feeling happy                                         | 36        | 34.9    |
| Still in fear of long-term side effects               | 16        | 15.5    |
| Neutral                                               | 3         | 2.9     |
| Feeling safe from complications of COVID-19 disease   | 1         | 0.9     |
| Feeling grateful                                      | 1         | 0.9     |
| Feeling partially safe                                | 1         | 0.9     |
| Feeling the same need to take precautions             | 1         | 0.9     |

DISCUSSION

This is a pioneer study regarding vaccine hesitance among HCW in Kerala. In the present study among 126 HCW, it was interesting to note that majority (76.9%) relied on WHO official website for COVID-19 related information. In a similar study conducted among healthcare professionals of Egypt, colleagues (78.96%) and social media (77.66%) were the main source of information. It points to the fact that healthcare professionals in Kerala were observed to have a more negative attitude whereas 23% thought that there was still much hesitance and fear regarding COVID-19 vaccination among HCW in Kerala.

The present study stands out in the sense that it took into consideration different dimensions of attitude among HCW towards COVID-19 vaccination which other studies had not looked into. 93.7% of the study participants agreed that vaccines provided in India were safe and 82.5% thought they were effective. 58.7% disagreed that even without vaccination, the pandemic would subside on its own by developing herd immunity. 94.5% believed that since HCW deal more closely with COVID-19 patients, they should be vaccinated and 93.6% agreed that it was only fair to vaccinate them in the initial phase of the pandemic before the general population. Majority (81.7%) said as they were frontline workers with the highest risk, they deserved vaccination first. 96.9% had positive attitude towards practicing infection control measures even after vaccination.

Majority (56.3%) thought the protection of vaccine would last for 3 months to 1 year. All the study participants would recommend vaccination for others. This was in contrast to the study done by Fares et al where only 42.08% of the HCW were willing to do the same. This again points to the strong positive attitude among HCW in Kerala. This attitude also reflected on the good practice. This was again in line with the findings of the Egyptian study where HCW who recommended vaccination for others had 17 times
higher odds of acceptance.\textsuperscript{11} 55.5% preferred other vaccines to the two vaccines given in India and Pfizer was the most preferred vaccine (43.6%). This was similar to the study done by Metwali et al where HCW preferred vaccines of US origin (55.3%).\textsuperscript{19} But in a study done in India, 26.9% preferred a foreign or imported vaccine, 36.9% preferred a domestic (Indian) vaccine and 36.2% agreed on either.\textsuperscript{20}

Duration of protection (61.1%), protection against new strains (57.1%), inadequate studies on long term effects (47.6%) and inadequate clinical trials (26.9%) were the most common concerns among the study participants. This was similar to many studies done across the world.\textsuperscript{10,11,12,17,21} Concerns for safety, efficacy and effectiveness and distrust of the government were barriers to vaccination according to a systematic review done by Li et al.\textsuperscript{17} Fares et al in their study showed that the reasons for vaccine hesitancy and refusal were inadequate clinical trials (92.4%) and fear of vaccine’s side effects (91.4%).\textsuperscript{11} Another study reported lack of trust in vaccine safety (85%) and receiving little (78%) or conflicting (69%) information about vaccines as reasons for the same.\textsuperscript{22} A concern with proper storage was the biggest barrier to acceptance of vaccine in another study.\textsuperscript{23} It should be noted that 3.9% of the HCW in this study had concerns regarding fertility following vaccination. Even though a small percentage, they could spread wrong information and negative attitude in the community. Hence it is utmost important to address these concerns with supporting scientific evidence. Li et al in their study, also suggested tailored communication strategies and more transparency on safety and efficacy of vaccines to increase the vaccine acceptance of HCWs.\textsuperscript{17}

Among the vaccines (N=103), 79.6% had experienced adverse effects following vaccination. Fever (51.4%), injection site pain (45.6%) and myalgia (41.7%) were the most common adverse effects in this study. This was in line with the reported side effects of covishield.\textsuperscript{23} None had serious adverse effects requiring hospitalization. Pain at injection site (89.8%), fatigue (62.2%), headache (45.6%) and myalgia (37.1%) were the most commonly reported side effects among HCW in Czech Republic.\textsuperscript{24} Similar findings were reported in a study done in Kathmandu,\textsuperscript{25} 50.88% of the participants reported AEFI after taking Covishield, in a study done in Bangladesh, of which swelling and pain at the injection site (37.07%) and fever (25.84%) were the most common.\textsuperscript{26}

Protection of self and family was the strongest motivation for vaccination among 82% of the vaccines, followed by protection of patients (6.8%). Singhania et al in their study also reported protection of self (66.0%), family (65.1%), the patients (40.5%), and the entire community through herd immunity (54.7%) as the reasons for taking vaccination.\textsuperscript{27} 80.7% of the vaccines in this study had a positive feeling after vaccination. They felt confident/happy/grateful/safe from complications, whereas 15.5% were still in fear of long-term side effects of the vaccine.

**CONCLUSION**

From the present study, it could be concluded that most of the HCW had positive attitude and practice towards COVID-19 vaccination. This would in turn help to prevent vaccine hesitance among the public as HCW influence their decision on vaccine acceptance. However, there were still concerns regarding the same which should be addressed.

The major limitation of our study was that it had a small sample size and the study population consisted mainly of modern medicine practitioners, so results might not be generalized to the entire HCW community. Further, the adverse effects were self-reported, hence there could be bias and misrepresentation.

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